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The
ANIMAL KINGDOM,
ARRANGED ACCORDING TO ITS ORGANIZATION
Serving as a
Foundation for the
NATURAL HISTORY OF ANIMALS,
AND AN
INTRODUCTION TO COMPARATIVE ANATOMY.

BY
BARON CUVIER,
PERPETUAL SECRETARY TO THE ROYAL ACADEMY OF SCIENCES, ETC. ETC.
WITH FIGURES DESIGNED FROM NATURE.

THE
Crustacea, Arachnides & Insecta,

BY
M. Latreille,
Member of the Royal Academy of Sciences, Etc. Etc. Etc.

Translated from the latest French Edition.

with
NOTES AND ADDITIONS.

by
H. M. MURTRIE, M. D. &c. &c.

in Four Volumes

Vol. II.
REPTILES-FISHES.

LONDON:

G. Henderson 2, Old Bailey, Ludgate Hill,
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MEMOIR OF LINNÆUS.



CARL LINNÆUS, the subject of this Memoir, was born 24th May, 1707, at Rashult, in the province of Smaland, while his father was still comminster. With an inheritance of his father's love for plants, and their cultivation, he is thus recorded by one of his pupils : " From the very time that he first left the cradle, he almost lived in his father's garden, which was planted with some of the rarer shrubs and flowers; and thus were kindled, before he was out of his mother's arms, those sparks which shone so vividly all his lifetime, and latterly burst into such a flame."

The elder Linnæus wished, and intended, that his first-born should succeed him in the office of pastor; and he endeavoured to regulate the clerical education of his son, as far as his means would permit. At the age of seven, Linnæus was placed under the private charge of John Ziliander; and two years afterwards was entered to the school of Wenid; but in both these places the discipline is said to have been severe, and not well fitted for the advancement of a young man of his mild temper, and he was soon after placed under another private tutor, who possessed a more conciliating disposition. His distaste for ordinary studies could not be so easily overcome; and it was not till three years after that he received promotion to a higher *form* in the school, called the *circle*. In this rank he was allowed more leisure, which was invariably devoted to his favourite pursuits, and chiefly his earliest—that of plants.

" According to the system of education at this time employed in Sweden, it was necessary that young men should pass from the schools, or from private teachers, to what is called the gymnasium, where the higher branches of literature was taught; and at the age of sixteen, Linnæus was placed at this seminary. Here he still continued his dislike for those studies particularly necessary for a divine; and began to show a more decided taste for botany, by forming a small library of such books as he could procure upon this science, and from

his studious perusal of them, acquired the college name of the ‘ Little Botanist.’

Nearly two years after, the elder Linnæus came to Wenid, to ascertain the progress of his son’s studies; and the disappointment of the sanguine hopes of a parent may be conceived, when the recommendations of his preceptors extended only to his ability for some manual employment; and the farther expense, in forcing a learned education, would be comparatively thrown away. The old clergyman, having for some time laboured under a complaint which might have now increased from his anxiety, was obliged to consult Dr. Rothman, a provincial physician; and grieving at the seemingly wayward and careless disposition of his son, he opened his mind to the doctor, who kindly prescribed for both his mental and bodily sufferings. He remarked, that although the boy might be unfit to follow that profession in which his father would have wished to have seen him his successor, there was the greater hope that some other study would be more ardently pursued; that he might yet arrive at eminence in medicine, as being more intimately connected with that branch of his own choosing; and he offered to give young Linnæus board and instruction during the year, which it was still necessary he should make up at the Gymnasium.

The offer of Dr. Rothman was gratefully accepted; and that gentleman faithfully redeemed his promises. He gave his now willing pupil instructions in physiology and botany, pointing out the advantages of studying the latter science according to the system of Tournefort. In both Linnæus made considerable proficiency, had already commenced to arrange every plant in its proper place, and even to doubt the situations of many whose characters had not been properly ascertained.

Next year it was thought necessary that Linnæus should complete his education at some university; and, upon applying at the Gymnasium, he received the following metaphorical testimonial, which will show the little esteem in which his qualifications as a scholar were held; and is a curious example of the manner in which the professors worded their certificates: ‘ Youth, at school, might be compared to shrubs in a garden, which will sometimes, though rarely, elude all the care of the gardener: but, if transplanted into a different soil, may become fruitful trees.’ With this view, therefore, and no other, the bearer was sent to the university, when it was possible that he might meet with a climate propitious to his progress.

With this certificate he proceeded to the university of Lund; and only procured admittance by the interest of his old preceptor Hök,

who withheld the testimonial, and introduced him as his private pupil."

Looking at this apparently so unfavourable a beginning of life, it seems almost incredible that this backward scholar, who could not be induced to learn any thing, should have, in after-life, stood in so high a rank as a man of science, that his fame attracted to the out-of-way kingdom of Sweden, pupils from all quarters of the world, in the same way as his distinguished countryman Berzelius, the chemist, is doing at the present time. One of the first enterprises of moment undertaken by the young Linnæus, was an expedition to explore Lapland, under the patronage, and at the expense, of the Royal Academy.

On account of the season the journey could not be commenced before the spring; and Linnæus did not set out before the 13th May, 1732. He commenced the journey in high spirits, and in love with nature; travelled on horseback; and carried his whole baggage on his back. It may be worth while to describe his dress and implements in his own words, from the narrative laid before the Academy of Sciences: "My clothes consisted of a light coat of West Gothland linsey-wolsey cloth, without folds, lined with red shalloon, having small cuffs, and collar of shag; leather breeches; a round wig; a green leather cap; and a pair of half-boots. I carried a small leathern bag half an ell in length, but somewhat less in breadth, furnished on one side with hooks and eyes, so that it could open and shut at pleasure. This bag contained one shirt, two pair of false sleeves, two half-shirts, an inkstand, pencease, microscope, and spying glass; a gauze cap, to protect me occasionally from the gnats; a comb; my journal; and a parcel of paper, stitched together, for drawing plants, both in folio; my manuscript ornithology, *Flora Uplandica*, and *Characteres Generici*. I wore a hanger at my side; and carried a small fowling-piece; as well as an octangular stick, graduated for the purpose of measuring. My pocket-book contained a passport from the Governor of Upsala, and a recommendation from the Academy." During the rest of this excursion, he made use of the mode of travelling which was best suited to the roads and passes, and performed the greater part of it on foot. Many hardships were necessarily undergone from the climate and nature of the country. His life was often periled in crossing rapid rivers, upon the rude boats or rafts constructed by the inhabitants, and endangered in a dreary waste of almost unbounded snow, where the tracts of the rein-deer, and the degree of heat retained by their dung, were the only guides to the huts of their masters; and he was even once fired on, by a native on the coast of Finmarck. Notwithstanding these difficulties, he has eulo-

gised the country, in the *Flora Laponica*, as all that could be desired, happy, and smiling; free from many diseases, and the scourge of war; and possessing plentiful resources in itself; while the inhabitants are said to be innocent and primitive, displaying the greatest hospitality and kindness to a stranger. In the journey, he travelled over the greater part of Lapland, skirting the boundaries of Norway, and returned to Upsala by the Gulf of Bothnia, having passed over an extent of above 4000 miles. He considered his labour amply remunerated by the information he had gained, and the discovery of new plants upon the higher mountains, and the payment of his expenses, amounting to about 10*l*.

The tour which was thus made by the young Linnæus has been published in English by the late Sir J. E. Smith, and though not very well written, the curious particulars contained in it, render it well worth perusal. It is probable, we think, that Linnæus might never have been heard of beyond the confines of Sweden, had not the refusal of a marriage proposal on the ground of his poverty, induced him to visit Holland, in order to graduate as a physician. Instead of one year's absence, however, as originally intended, he was detained about three years; during which time he visited England and France, became acquainted with Boerhaave and most of the distinguished naturalists of the age; and published some of the works on which his future celebrity became founded. On his return to Sweden he commenced practising as a physician, and married the lady whose hand had been before refused him. His subsequent career is well known. He was soon chosen to fill the botanical chair, which he did with great reputation for more than forty years. To sum up his character:—

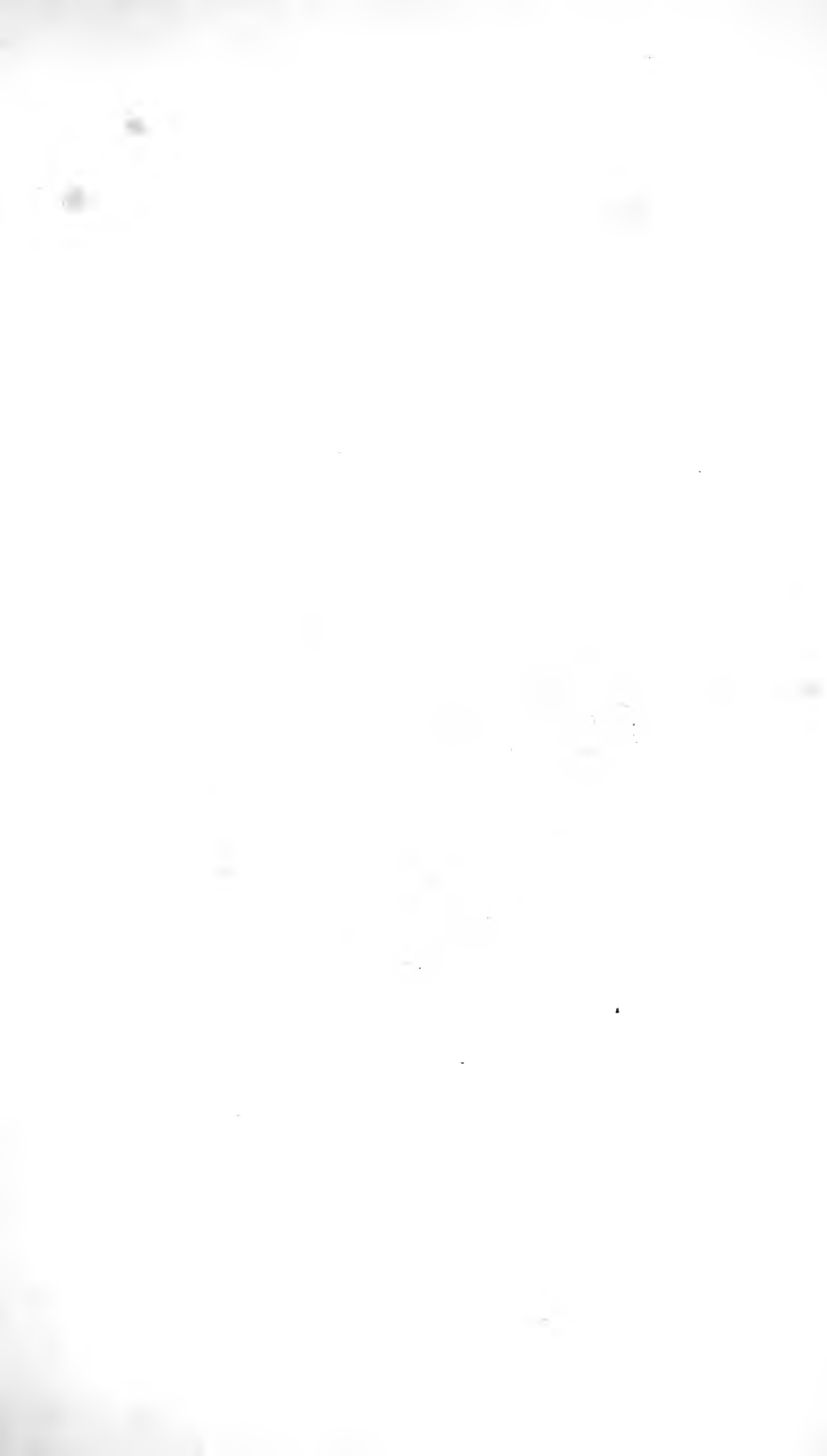
His mind was ardent and enthusiastic in the highest degree, particularly in following out his beloved science; he never, however, in his enthusiasm, lost sight of the First Great Cause, but looked truly up to Nature's God, as the giver of all his benefits and acquirements. Over the door of his room was inscribed,—“*Innocuè vivito—Numen adest.*” And when enumerating in his diary his various successes in life, he commences, “The Lord himself hath led him with his own Almighty hand;” and sums them up with “The Lord hath been with him whithersoever he hath walked, and hath cut off his enemies from before him, and hath made him a name like the name of the great men that are in the earth.” The most important of his works commence and finish with some verse from the Scriptures, implying the power or greatness of God, or his own gratitude to Providence, for the innumerable benefits conferred upon himself,

and the inhabitants of the world; and his descriptions are continually interspersed with expressions of admiration, of gratitude, and love

His memory was most comprehensive, and remained almost unimpaired till his sixtieth year; but the most remarkable feature in his comprehensive mind, was the power to seize upon the essential characters of whatever he was engaged with, to separate the useful from the useless, and at once to characterize them with that decision and clearness, which so peculiarly mark his writings and descriptions. A better example of this cannot be referred to, and his style will be better understood in the perusal, than in his *Imperium Naturæ*, or the preface to three kingdoms in his *Systema Naturæ*.

This love of order was equally conspicuous in his domestic arrangements. In winter he slept from nine to six, in summer from ten to three; but he never extended his application of mind beyond the moment at which he felt fatigue, and whatever fact came to his knowledge, he noted it immediately in its proper place. He was frugal in his way of living, and in his greatest prosperity never gave way to extravagance or ostentation; he was a strict economist, yet liberal in conferring benefits. He often relieved his pupils when in want, and was always ready to assist them in their travels, either by money or advice. In his capacity as teacher, he possessed the faculty of interesting his hearers, and of easily making himself understood, and his pupils looked upon him more in the light of a counsellor, or beloved adviser, than as a grave or austere professor.







THE NATIONAL ANTHROPOLOGICAL ARCHIVES

MEMOIR OF BUFFON.

THE illustrious naturalist whom we have chosen for the subject of the present memoir, is an instance among many others ; and although he was fortunate in procuring an education of the most liberal kind, which embraced in its range polite literature and the sciences, and was extended by means of foreign travel and the companionship of polished minds, he had passed his thirtieth year before designing the plan of his extensive works on nature, and the first branches of the animal kingdom.

George Louis le Clerc Buffon, was born at Montbard* in Burgundy, in September 1707, and his father, Benjamin le Clerc Buffon, being a counsellor of Parliament in the district, naturally wished that his son should study his own profession, and, if possible, assist and succeed him in the discharge of its duties. There are a few existing records of the early life of Buffon ; and except that he pursued the studies which he undertook, with great ardour and perseverance, we know little of his youthful habits and propensities.

His first public tuition was at the Jesuit's College of Dijon, where he was placed to study the profession of the law ; but his dislike for this employment, and the zeal with which he followed the more abstruse sciences, prevented his father from insisting upon a continuation of his legal studies, and gradually permitted him to pursue those of own selecting. Astronomy and mathematics, were his early passion ; and the young Le Clerc was seldom without a copy of Euclid in his pocket, and was often observed to retire from his companions at play, and to attempt, in some solitary corner, the solution of any problem with which he had been perplexed.

* Buffon's house seemed the large habitation of a tradesman rather than the residence of a man of rank. It is in the High Street, and the court is behind. You ascend a staircase to go into the garden, which is raised on the ruins of the ancient mansion of which the walls make the terraces. On the top there still remains an octagon tower, where Buffon made his observations on the reverberations of air. The elevation of this tower is 140 feet above the level of the little river Braine, which crosses the town. This singular and picturesque garden is well worthy the notice of the curious ; and the numerous foreign trees which the illustrious proprietor had collected, form agreeable arbours.—MILLIN'S *Travels*.

This constant study and perseverance, at a period so early, and when youthful minds are generally most idly inclined, was attended with very brilliant results. He is said to have anticipated Newton in some of his discoveries, and, in after-life, withheld the circumstances.

At the college of Dijon he became acquainted with the young Duke of Kingston, who was travelling in Italy, accompanied by a tutor. Buffon fortunately became acquainted with both; and the latter, being a man of considerable attainments, and devoted to the sciences, found a ready access to the mind of a youth endowed with such temper and abilities. It was agreed that he should accompany them in the prosecution of their travels, and he became equally acceptable to his friends, and pleased with their society; afterwards remarking, that while the one became his companion in pleasure and amusements, the other gained his esteem by his more solid qualifications.

They travelled amidst all that is placid and sublime in nature, or lovely in the arts, he continued to pursue the more abstracted departments of science, almost neglecting the artificial productions; and at this same period seems to have imbibed many of the theories and ideas, which fancifully, but eloquently, adorned the chapters of the first volumes of his great work.

At the age of twenty-one Buffon lost his mother; and by her death succeeded to an income of nearly twelve thousand pounds yearly. An accession of such an amount to his fortune, enabled him to follow out every design which his studies had suggested; but it also allowed him to pursue, with almost unlimited control, every indulgence which his inclinations prompted. His European travels still appear to have been continued, and after his return to Montbard, being embroiled in some affair of honour which required his absence until matters were arranged, he visited Paris and England, and did not finally settle at his paternal residence, till about the age of twenty-five, when he determined quietly to pursue the studies in which he had so much delighted. He seems to have laid down for himself, even at this early period, a decided and rigorous division of his time, and to have attended generally to the Sciences, Natural History, and Polite Literature.

The division of his time and labour was thus: "After he was dressed, he dictated letters, and regulated his domestic affairs; and at five o'clock he regulated his studies at the pavilion called the Tower of St. Louis. This pavilion was situated at the extremity of the garden, about a furlong from the house; and the only furniture which it contained was a large wooden secretary and an armed chair.

"No books or pictures relieved the naked appearance of the apartment,

or distracted the thoughts of the learned possessor. Within this was another cabinet, where Buffon resided the greater part of the year, on account of the coldness of the other apartment, and where he composed the greater number of his works. It was a small square building situated on the side of a terrace, and was ornamented with drawings of birds and beasts. Prince Henry of Prussia called it the cradle of natural history; and Rousseau, before he entered it, used to fall on his knees and kiss the threshold. At nine o'clock, Buffon usually took an hour's rest; and his breakfast, which consisted of a piece of bread and two glasses of wine, was brought to the pavilion. When he had written two hours after breakfast, he returned to the house. At dinner he spent a considerable portion of time, and indulged in all the gaieties and trifles which occurred at table. After dinner he slept an hour in his room, took a solitary walk, and during the rest of the evening, he either conversed with his family or guests; or sat at his desk examining the papers which were submitted to his judgment. At nine o'clock he went to bed, to prepare himself for the same routine of judgment and pleasure. In this manner were spent no fewer than fifty years of his life."

During the whole period of Buffon's career, we find him particular and anxious regarding the purity and elegance of his style; and he translated many standard works in various languages, with the view of improving it. The first of these which he published was "*Hales's Vegetable Staticks*," accompanied with an appropriate preface of considerable length and ability. At this time he also instituted and carried through experiments, to prove the relative strength of the different woods which were used in France for purposes of public utility, and the best season for cutting the timber.

The next subject with which he became interested, was the manner in which the Roman fleet under command of Marcellus, was set on fire by Archimedes, and which was supposed could not be accomplished by means of burning mirrors, as has been recorded. Buffon commenced his researches with ardour and perseverance, and his experiments were eminently successful. They are the most important which he performed, in those branches unconnected with natural history; and it is probable, that, had he not been appointed Intendant of the Royal Garden and Cabinet, the various branches of mathematics, optics, &c., would have received part of his attention, and might have been attended with the most splendid results.

Buffon commenced his researches, with the view of constructing a burning mirror, which would be capable of performing, what had been thought Archimedes could not have executed; but, before commen-

cing the plan, it was necessary to perform many preliminary experiments, relating to the loss of light by reflection, and the best materials which could be used for the construction of the lenses. These accomplished, he commenced to build his great mirror. It was composed of 168 pieces of plain silvered glass, six inches by eight in size, and he required to examine above 500 pieces before the most perfect could be obtained. Between each was an interval of four lines, to allow a free motion, and to permit the observer to see the place, to which the images were to be thrown. The whole were mounted in an iron frame so fitted with screws and springs, that a motion could be given to them in any direction, and the images reflected from all the mirrors easily thrown upon the same spot. In eight experiments, he obtained the following results, which clearly show the possibility of setting fire to the Roman fleet:—On March 23d, a plank of tarred beech was set on fire at sixty-six feet, with only forty mirrors, and without the mirror being put upon its stand. On the same day, a plank tarred and sulphured, and having the mirror more disadvantageously placed, was fired, at the distance of 126 feet, with 98 mirrors. On the 3d of April, at four o'clock in the evening, a slight inflammation was made upon a plank covered with wool cut into small pieces, distant 138 feet, with 112 mirrors. The next day, at eleven o'clock forenoon, 154 mirrors, at the distance of 150 feet, made a tarred plank smoke to such a degree in two minutes, that it would have been inflamed had not the sun disappeared. On the 5th April, a dull day, at three o'clock in the afternoon, 154 mirrors, at a distance of 250 feet, inflamed in two minutes and a half, minute chips of deal, sulphured and mixed with charcoal. When the sun was vivid, the inflammation took place in a few seconds. On the 10th April, after mid-day, with a clear sun, 128 mirrors, at the distance of 150 feet, set fire to a tarred plank of fir; the inflammation being very sudden. Same day, at half-past two, 148 mirrors, at 150 feet, fired a plank of beech sulphured in some parts, and in others covered with wool cut into small pieces; the inflammation was so sudden and violent, that it was necessary to plunge the plank into water in order to extinguish it. April 11, twelve mirrors, at twenty feet, inflamed some combustible matters; forty-five, at twenty feet, melted a large pewter flask that weighed six pounds; and 117 made some thin pieces of silver and iron red-hot. Having satisfied himself upon this point, he followed out the subject, and constructed mirrors upon various plans. Perhaps the most remarkable were those formed by bending glass upon moulds of a spherical form by means of a furrow; he was thus able to make them of very considerable size, but they required great caution in the cooling and grinding

afterwards ; and, out of twenty-four which he made, only three were able to be preserved. One of these, forty-six inches in diameter, was presented to the King of France, and was regarded as the most powerful burning mirror in Europe.

A few years before the commencement of these experiments, Buffon succeeded to M. Du Fay in the office of Intendant to the Royal Garden and Cabinet, and, as before hinted, this appointment ultimately fixed his mind to the pursuits of natural history. He was only thirty-two years of age ; and when he saw such a mass of materials at his command, a great part of which was unnoticed by any naturalist, we may easily conceive that a mind possessed of such enthusiasm, would be led again to a science which it had previously studied. The great work contemplated, was intended to embrace every branch of the animal kingdom ; but he thought it would be incomplete, unless the composition of the globe which sustained such a multitude of living creatures, should itself be first elucidated, and it was accordingly commenced by a history or theory of the earth, which he afterwards augmented by what he termed the "Epochas of Nature." The first volume of the *Natural History of Quadrupeds* did not appear till 1749, ten years after his appointment as Intendant of the Gardens ; and the first edition of the whole work was not completed till 1767, occupying its author during a period of sixteen years. In 1782, only six years before his death, we find a supplementary number published. During the progress of the work, he appears also to have kept up that unremitting perseverance which characterises the pursuits of his earlier years, and he is said to have employed fourteen hours daily in writing and study.

Previous to the publication of the first volume of his *Natural History*, Buffon was enabled to increase his domestic felicity, by a marriage with a lady with whom he had been for some time acquainted. In 1752, he married Mademoiselle Saint Belin, who though without fortune, possessed qualifications which rendered the happiness of her husband undoubted. She eagerly followed the train of honours which was now brightly expanding upon him, and watched every step which he gained with fresh anxiety ; many years seemed thus to have passed in great tranquillity, and present an unvaried routine of research and addition to the works which were advancing. During the height of this bright career, he was honoured with marks of approbation by many of the sovereigns of Europe, and by the learned societies of his country.

During his whole life he enjoyed a singular portion of good health, notwithstanding the irregularities which all his biographers allow that he frequently indulged in.

Buffon continued for nearly eight years in severe affliction previous to his death: he retained his reason till within a few hours of his death, but sunk under excruciating torture, on the 16th April 1788, in the eighty-first year of his age. His body was embalmed and conveyed to Montbard, to be placed according to his directions, in the same vault with that of his wife. Every earthly honour was paid to his memory: a concourse of academicians, and of persons of rank and distinction, attended the funeral: a monument was erected to his memory; and though there is much to blame in the private character of Buffon, his name as a naturalist will long continue to be remembered.

Buffon left one son, who inherited considerable abilities, and appears to have been fondly attached to his parent. He entered the army, and rose to the rank of major in the regiment of Angoumois. He was destined, however, to live in a more unsettled period, and during the revolution was condemned to death, and perished on the scaffold. The abilities of the father were no safeguard for the son; nor was the utility of his own works, or his kindness during life to his retainers, a greater protection afterwards to his own remains, against the ruthless hands of popular fury. The hatred to the noblesse and aristocracy of France was borne by so violent a tide, that the remains of this illustrious naturalist were torn up and left unburied, the leaden coffin carried off, and his monument razed to the ground.

The personal appearance of Buffon is said to have been commanding, while his countenance was intelligent. Our engraving represents his forehead high and ample, but we should scarcely say that his countenance was very prepossessing.

The study of a subject, so as to acquire its mastery, must however cost considerable labour; and he was always inclined to be led away by beauties or defects, which a lively power of imagination presented. This we can every where trace in his writings; by the best judges they have been pronounced elegant, but more attention is always given to the style and detail as it were, of the story, than to that rigid adherence to truth which is so essentially required by the naturalist. This may be preserved without dry and weary detail, and at the same time without wandering theoretically from the subject. Nature presents innumerable instances, where there is no need of any embellishment, beyond the garb in which she has already dressed them, and where the gaudy trickery of language is unnecessary, to give additional lustre to her beautiful but chaste productions.

M. De Buffon's conversation was unadorned, rarely animated, but sometimes very cheerful. The power of communicating information

was either wanting, or reserved for his particular friends in private, and he considered that a discussion upon the Sciences should be confined to books alone. These opinions may have influenced his wish for comparative privacy, and it is certain that he did not mingle with his contemporaries in literary and scientific fame.

Vanity has been generally allowed to be the greatest failing in the mind of Buffon, and the pains which he took to work up his writings, and his severe study, have perhaps been too often invidiously referred "to the consideration of what after generations would think regarding him." He delighted in reading aloud his own works to his visitors, and chiefly those which he considered his finest pieces. Parts of the *Natural History of Man*, and that of the *Swan*, &c., were his favourites. It is but justice to say, however, that a more laudable inducement to recite them, than the mere love of hearing them praised, has been assigned by some of his biographers. "They were read with the view of hearing opinions and receiving corrections;" he willingly received any hint of improprieties of style, and was open to imperfections when pointed out to him.

He delighted also in what was luxurious or magnificent, and was devoted to his dress almost to the extreme of foppery. He spent much time at his toilet, and even in his latest years had his hair dressed and powdered twice, or three times daily.

In the private character of Buffon, there is not much to praise. In early youth he had entered into the pleasures and dissipations of life, and licentious habits seem to have been retained to the last. But the great blemish in such a mind was his declared infidelity; it presents one of those exceptions among the persons who have been devoted to the study of Nature; and it is not easy to imagine a mind apparently with such powers, scarcely acknowledging a Creator, and when noticed, only by an arraignment for what appeared wanting or defective in his great works. So openly, indeed, was the freedom of his religious opinions expressed, that the indignation of Sorbonne was provoked.

Painful as a detail of such opinions must be, it is the duty of every biographer to mention them; and our readers may compare the splendid talents and humble piety of the subject of our first memoir, with the highly cultivated mind, the bright abilities of the present, where they but coupled with the disavowment of the Being from whom all these precious gifts were derived.

The works by which Buffon is now best known, are those upon *Natural History*. The first of these, "*Natural History, General and Particular*," amounted to fifteen volumes quarto; in the anatomical

department he was assisted by M. D'Aubenton, and a supplementary volume afterwards appeared. This contained only the Natural History of Quadrupeds. On account of his illness, the first volumes of the History of Birds did not appear till 1771; in which he was assisted by M. Gueneau de Montbeillard, and in the three last he received help from the Abbé Beron. They form nine volumes. He afterwards published a volume containing the "Natural History of Minerals," and several supplementary additions, and he intended to have added the History of Vegetables. The whole of these have been published in thirty-eight volumes 4to., of which several translated editions have appeared in this country. His other works, some of which we mentioned before, were the translation of "Newton's Fluxions," a "Treatise on Accidental Colours," with various papers in the "Memoirs of the Royal Academy of Science at Paris, from the year 1737 to 1742."

INDEX

SYSTEMATICALLY ARRANGED.

FIRST GREAT DIVISION OF THE ANIMAL KINGDOM.

THIRD CLASS.

REPTILES.

ORDERS, GENERA, SUBGENERA, AND OTHER DIVISIONS.

General character of the Class, 1

Division into Orders, 3

ORDERS.

I. CHELONIA,

II. SAURIA,

III. OPHIDIA,

IV. BATRACHIA.

I. CHELONIA, 3

Gen.—Testudo, 5

Subgen.—Testudo, 5

Emys, 6

Testudo Indica, 7

Chelodina, 7

Hydraspis, 7

Terrapene, 7

Kinosternon, 7

Cistuda, 7

Caretta, 7

Chelydra, 7

Chelonura, 7

Gen.—Chelonia, 7

Sphargis, 8

Coriudo, 8

Dermochelis, 8

Gen.—Chelys, 9

Gen.—Trionyx, 9

Matamata, 9

II. SAURIA, 11

Fam. I. CROCODILA, 11

Crocodilus, 11

II. SAURIA—(*continued*).

- Loricata, 12
- Emydosauria, 12
- Gavials, 12
- Crocodylus—proper, 13
- Thelecosaurus, 13
- Stenecosaurus, 13
- Alligator, 14

Fam. II. LACERTINIDA, 16*Gen.*—Monitor, 16

- Monitor—proper, 16
- Varanus, 17
- Psammosaurus, 17
- Tupinambis, 17
- Crocodylurus, 18
- Teius, 18
- Ada, 18
- Safeguards, 18
- Ameiva, 19
- Gen.*—Lacerta, 20
- Algyra, 20
- Tachydromus, 20

Fam. III. IGUANIDA, 20*1st Section.*—Agamians, 21*Gen.*—Stellio, 21

- Cordylus, 21
- Stellio-proper, 21
- Zonurus, 21
- Doryphorus, 22
- Uromastix, 22

Gen.—Agama, 22

- Agama, 23
- Tapayes, 24
- Trapelus, 24
- Leiolepis, 24
- Tropidolepis, 24
- Leposoma, 24
- Tropidosaurus, 24
- Calotes, 24
- Lophyrus, 25
- Gonocephalus, 25
- Pneustes, 26
- Phrynocephalus, 26
- Lyriccephalus, 26
- Pneustoidea, 26
- Brachylophus, 26
- Physignathus, 26

Gen.—Istiurus, 26

Lophura, 26

Draco, 27

(continued)

II. SAURIA—(continued).

Gen.—Sitana, 27

Pterodactylus, 28

2nd Section.—Iguanians proper, 28*Gen.*—Iguana, 28

Ophryessa, 29

Basilus, 29

Polychrus, 30

Ephemotus, 30

Oplurus, 30

Anolius, 31

Mosasaurus, 32

Geosaurus, 32

Megalosaurus, 32

Iguanodon, 32

Fam. IV. GECKOS, 33

Gecko, 33

Asaral Rotes, 33

Stellio, 33

1st Division } *Platydyctyli*
of Geckos. }

Phelsuma, 34

Tarentola, 34

Ptychozoon, 35

Pteropleura, 35

2nd Div. Hemidactyli, 36*3rd Div.* Thecadactyli, 36*4th Div.* Ptyodactyli, 37

Uroplates, 37

Sarruba, 37

5th Div. Spherialactyli, 37

Stenodactyli, 38

Gymnodactyli, 38

Phyllurus, 38

Fam. V. CHAMÆLEONIANS, 38

Chamæleo, 38

Fam. VI. SCINCOIDEA, 40

Scincus, 40

Mabouia, 41

Tiliqua, 41

Pterogasterus, 41

Seps, 42

Lygosoma, 42

Zygnis, 42

Monodactylus, 43

Chamœsaura, 43

Pygopus, 43

Bipes, 43

Scelotes, 43

(continued)

II. SAURIA—(*continued*).

Pygodactylus, 43
 Bipes, 43
 Chalcides, 43
 Tetradactylus, 44
 Saurophis, 44
 Brachypus, 44
 Chalcis, 44
 Copheas, 44
 Colobus, 44
 Chirotas, 44
 Ichthyosaurus, 44
 Plesiosaurus, 44
 Hylæosaurus, 45

III. OPHIDIA, 45

Fam. I. ANGUINA, 45

Anguis, 46
 Pseudopus, 46
 Ophisaurus, 46
 Anguis proper, 46
 Acontias, 47

Fam. II. SERPENTIA, 47

1st *Tribe*. Amphisbœna, 48
 Leposternon, 48
 Typhlops, 49
 2nd *Tribe*. Serpents proper, 49
 Venomous, 49
 Non-venomous, 50
 Venomous Tortrix, 50
 Uropeltas, 50
 Anilius, 50
 Torquatrix, 50
 Ilysia, 50
 Non-venomous Boas, 51
 Coralles, 52
 Xiphosoma, 52
 Cenchris, 52
 Scytale, 52
 Erix, 52
 Erpeton, 52
 Coluber, 53
 Python, 53
 Cerberus, 53
 Xenopeltis, 53
 Heterodon, 53
 Hurria, 54
 Dipsas, 54
 Bungarus, 54

(*continued*)

III. OPHIDIA—(*continued*).

Dendrophis, 54
 Ahoetulla, 54
 Drynius, 54
 Dryolines, 54
 Passerita, 54
 Oligodon, 55
 Tyria, 55
 Malpolon, 55
 Psammophis, 55
 Coronella, 55
 Xenodon, 55
 Pseudoelaps, 55

*True Venomous Serpents, Acrochordus.**Gen.—Crotalus, 57*

Trigonocephalus, 58
 Bothrops, 58
 Cophias, 58
 Tisiphone, 58
 Crotalophorus, 58
 Craspedocephalus, 58
 Lachesis, 59

Gen.—Vipera, 59

Echidna, 59
 Vipera, 59
 Colera, 59
 Corra, 59
 Aspis, 59
 Vipers, 59
 Adders, 59
 Pelias, 59
 Sepedon, 59
 Naïas, 60
 Elaps, 61
 Micrurus, 61
 Platurus, 61
 Trimeresurus, 62
 Oplocephalus, 62
 Acanthophis, 62
 Ophrias, 62
 Echis, 62
 Scytale, 62
 Langaha, 62

*Venomous Serpents with crooked, accompanied with other, teeth.**Gen.—Bungarus, 63*

Pseudoboa, 63
 Hydrus, 63
 Hydrus, 63
 Pelamis, 63
 Chersydrus, 63

(continued)

III. OPHIDIA—(*continued*).*Fam.* III. NAKED SERPENTS, 64*Gen.*—Cœcilia, 64

IV. BATRACHIANS, 65

Gen.—Rana, 66

Rana proper, 67

Ceratophris, 68

Stombus, 69

Dactylethra, 69

Engystoma, 69

Hyla, 69

Calamita, 69

Bufo, 70

Bombinator, 72

Rhinellus, 72

Oxyrynchus, 72

Otilophis, 72

Breviceps, 72

Engystoma, 72

Brachycephalus, 72

Pipa, 72

Salamandra, 73

Terrestrials, 74

Aquatic, 74

Triton, 74

Fossil Man, 75

Menopoma, 76

Abranchus, 76

Cryptobranchus, 76

Protonopsis, 76

Menobranchus, 76

Necturus, 76

Proteus, 77

Hypochton, 77

Siren, 77

FOURTH CLASS.

FISHES.

ORDERS, GENERA, SUBGENERA, AND OTHER DIVISIONS.

General character of the Class, 79

Division into Orders, 83

1st. Series. ORDINARY FISHES, OR FISHES PROPERLY SO CALLED.

ORDERS.

- | | |
|-----------------------------------|----------------------------|
| 1. Acanthopterygii. | 4. Malacopterygii, Apodes. |
| 2. Malacopterygii, Abdominales. | 5. Lophobranchii. |
| 3. Malacopterygii, Sub-brachiati. | 6. Plectognathi. |

2nd Series. CHONDROPTERYGIANS, OR CARTILAGINOUS FISHES.

FIRST SERIES.

ORDERS.

1. Sturiones, or Chondropterygians with Free Gills.
2. Chondropterygians with Fixed Gills.

ORDINARY FISHES.

I. ACANTHOPTERYGII, 84

Fam. 1.—PERCOIDES, 84*1st Subdivision.* Thoracic Perches, 85*Gen.*—Perca, 86

Labrax, 86

Lates, 86

Centropomus, 86

Grammustes, 86

Aspro, 86

Subgen.—Huro, 87

Etelis, 87

Niphon, 87

Enoplosus, 87

Diploprion, 87

Gen.—Apogon, 87

Cheilodipterus, 88

Pomatomus, 88

2d Subdiv.—Ambassis, 88*1st Div.*—Lucio-perca, 88*2d Div.*—Serranus, 89

Serranus, 89

Anthias, 89

Merra, 90

Bodianus, 90

Holocentri, 90

(continued)

I. ACANTHOPTERYGII—(*continued*).

Epinepheli, 90
 Cephalopholes, 90
 Lutjani, 90
 Anthias, 90

Plectropoma, 91
 Diacope, 91
 Mesoprion, 91

Perches with seven branchial rays, and a single dorsal.

Acerina, 92
 Rypiticus, 92
 Polyprion, 92
 Centropristis, 92
 Gustes, 93

Perches with less than seven branchial rays.

Cirrhitæ, 93
 Chironemus, 93
 Pomotis, 93
 Centrarchus, 94
 Priacanthus, 94
 Dules, 94
 Therapon, 94
 Datnia, 94
 Pelates, 94
 Helotes, 95
 Trichodon, 95
 Sillago, 95
 Holloccentrum, 95
 Myripristis, 96
 Beryx, 96
 Trachichtys, 96
 Trachinus, 96
 Percis, 97
 Pinguipes, 97
 Percophis, 97
 Uranoscopus, 98
 Polynemus, 98
 Sphyroæna, 99
 Paralepis, 99
 Mullus, 99
 Mullus proper, 100
 Upeneus, 100

Fam. II. MAILED CHEEKS, 100

Trigla, 101
 Trigla proper, 101
 Prionotus, 102
 Peristedion, 102
 Dactylopterus, 103

I. ACANTHOPTERYGII—(*continued*).

- Cephalacanthus, 103
- Cottus, 103
 - Cottus proper, 103
 - Aspidophores, 104
 - Agonus, 104
 - Phalangista, 104
- Henutripterus, 104
- Henulepidolus, 105
- Platycephalus, 105
 - Centranodon, 105
- Scorpæna, 105
 - Scorpæna proper, 105
 - Tænianotes, 105
 - Sebastes, 106
- Pterois, 106
- Blepsias, 106
- Apistus, 106
- Agriopus, 107
- Pelor, 107
- Syanceia, 107
- Lepisacanthus, 107
- Gasterosteus, 108
 - Gasterosteus proper, 108
- Oreosama, 108

Fam. III. SCIENOIDES, 199

- Sciæna, 109
 - Sciæna proper, 109
 - Otolithus, 109
 - Ancylodon, 110
 - Corvina, 110
 - Johnius, 110
 - Umbrina, 110
 - Lonchurus, 110
 - Pogonias, 110
- Eques, 111
- Hæmulon, 111
- Pristipoma, 111
- Diagramma, 112
- Lobotes, 112
- Cheilodactylus, 112
- Scolopsides, 113
- Micropterus, 113
- Amphiprion, 113
- Premnas, 113
- Pomacentrus, 113
- Dascyllus, 114
- Glyphisodon, 114
- Heliæsus, 114

I. ACANTHOPTERYGII—(*continued*).*Fam. IV. SPAROIDES, 114*

Sparus, 114
Sargus, 115
Crysophnis, 115
Pagrus, 115
Pagalus, 116
Dentex, 116
Pentapoda, 117
Lethrinus, 117
Boops, 117
Oblada, 117

Fam. V. MENIDES, 118

Moena, 118
Cæsio, 118

Fam. VI. SQUAMMIPENNES, 119

Chætodon, 119
Chætodon proper, 120
Chebron, 120
Heniochus, 121
Ephippus, 121
Taurichtes, 121
Holocanthus, 121
Pomaranthes, 122
Platax, 122
Psettus, 122
Pimelepterus, 122
Dipterodon, 123
Brama, 123
Pempheris, 123
Toxotes, 124

Fam. VII. SCOMBEROIDES, 124

Scomber, 124
Scomber, 124
Thynnus, 125
Orcynus, 125
Auxis, 126
Sanda, 126
Cybium, 126
Thirsites, 126
Gempylus, 127
Xiphias, 127
Xiphias proper, 127
Tetrapturus, 128
Makaira, 121
Istiophorus, 128
Notistium, 128

I. ACANTHOPTERYGII—(*continued*).

- Centronotus, 128
- Naucrates, 128
- Elacates, 129
- Lichia, 129
- Trachinotus, 129
- Rhynchobdella, 130
- Macrognathus, 130
- Mastacembelus, 130
- Notacanthus, 130
- Campilodon, 130
- Seriola, 130
- Nomeus, 131
- Temnodon, 131
- Caranx, 131
- Carangue, 132
- Citulo, 132
- Vomers, 132
- Olistus, 132
- Scyris, 133
- Blepharis, 133
- Gallus, 133
- Argyreyosus, 133
- Vomer proper, 133
- Zeus, 133
- Zeus, 133
- Capros, 134
- Lampris, 134
- Chrysotosus, 134
- Equula, 134
- Mene, 156
- Stromateus, 135
- Pamples, 135
- Peprilus, 135
- Luvarus, 136
- Seserinus, 136
- Kurtus, 136
- Coryphæna, 136
- Coryphæna, 137
- Caranxomorus, 137
- Centrolophus, 137
- Astrodermus, 137
- Pteraclis, 137
- Oligopodus, 137

Fam. VIII. TNOIDÆES, 138

- Lepidopius, 138
- Trichiurus, 138
- Lepturus, 138
- Gymnogaster, 139
- Stylephorus, 140
- Gymnetrus, 139

I. ACANTHOPTERYGII—(continued).

Cepola, 140
Lophotes, 141

Fam. IX. THEUTYES, 141

Siganus, 141
Buro, 141
Centrogaster, 141
Amphacanthus, 141
Acanthurus, 142
Harpurus, 142
Pronurus, 142
Naseus, 142
Monoceros, 142
Axinurus, 143
Priodon, 143

Fam. X. LABYRINTHIFORM PHARYNGEALS, 143

Anabas, 143
Polycanthus, 144
Manopodius, 144
Helostoma, 144
Osphrobenus, 144
Tricobetus, 144
Spiro-branchus, 145
Ophicephalus, 145

Fam. XI. MUGILOIDES, 146

Mugil, 146
Tetragonurus, 147
Alherina, 148

Fam. XII. GOBIOIDES, 149

Blennius, 149
Blennius proper, 149
Pholis, 150
Myoxodes, 150
Salarias, 150
Clinus, 151
Cirrhibarba, 151
Murænoides, 151
Opistognathus, 151
Zoarcus, 152
Anarrhicas, 152
Gobius, 152
Gobius proper, 153
Gobioides, 154
Tænioides, 154
Periophtalmus, 154
Eleotris, 155

I. ACANTHOPTERYGII—(*continued*).

Callionymus, 156
 Trichonotus, 156
 Comephorus, 156
 Platypterus, 157
 Chirus, 157
 Labrax, 157

Fam. XIII. PEDICULATED PECTORALES, 157

Lophius, 157
 Lophius proper, 158
 Chironectes, 158
 Antennarius, 158
 Malthe, 159
 Batrachus, 159
 Batracoides, 159

Fam. XIV. LABROIDES, 160

Labrus proper, 161
 Cheilinus, 161
 Lachnolaimus, 162
 Julis, 162
 Anampses, 163
 Crenilabrus, 163
 Coricus, 164
 Epibulus, 164
 Clepticus, 164
 Gomphosus, 164
 Elops, 165
 Xirichthys, 165
 Chromis, 165
 Cychla, 166
 Plesiops, 166
 Malacanthus, 166
 Scarus, 166
 Calliodon, 167
 Odox, 167

Fam. XV. FLUTE MOUTHS, 168

Fistularia, 168
 Fistularia proper, 166
 Aulostomus, 168
 Centriscus, 169
 Centriscus proper, 169
 Amphisile, 169

II. ABDOMINAL MALACOPTERYGIANS, 169

Fam. I. CYPRINIDÆ, 170
 Cyprinus, 170

II. ABDOMINAL MALACOPTERYGIANS—(*continued*).

Cyprinus proper, 170
Barbus, 171
Gobio, 172
Tinca, 172
Cirrhinus, 172
Abramis, 172
Labeo, 173
Catostomus, 173
Leuciscus, 173
Chelæ, 174
Gonorrhynchus, 174
Cobitis, 175
Anableps, 175
Pæcilia, 176
Lebras, 176
Fundulus, 176
Molenesia, 176
Cyprinodon, 177

Fam. II. ESOCES, 177

Esox, 177
Galaxias, 178
Alepocephalus, 178
Microstoma, 178
Stomias, 178
Chauliodes, 179
Salanx, 179
Belone, 179
Sombresox, 180
Sairis, 180
Hemiramphus, 180
Exocetus, 180
Mormyrus, 881

Fam. III. SILURIDÆ, 182

Silurus, 182
Silurus proper, 183
Silurus, 183
Shilbe, 183
Mystus, 184
Pimelodus, 184
Bagrus, 184
Pimelodus proper, 184
Synodontes, 185
Ageniosus, 186
Doras, 186
Heterobranchus, 186
Macropteronotes, 187
Plotosus, 187

II. ABDOMINAL MALACOPTERYGIANS—(*continued*).

- Callichthys, 187
- Cataphractus, 187
- Malapterus, 187
- Glatystacus, 188
- Aspredo, 188
- Loricaria, 189
- Hypostomus, 189
- Zoricaria, 189

Fam. IV. SALMONIDES, 189

- Salmo, 190
- Salmo proper, 190
- Osmerus, 192
- Mallotus, 192
- Thymallus, 192
- Coregonus, 193
- Argentina, 194
- Curimata, 194
- Anostomus, 195
- Gasteropelecus, 195
- Serpes, 195
- Peabucus, 195
- Serrasalmus, 195
- Tetragonopterus, 195
- Chalceus, 196
- Myletes, 196
- Hydrocyon, 196
- Citharinus, 197
- Saurus, 197
- Scopelus, 198
- Anlopus, 198
- Sternoptyx, 199

Fam. V. CLUPEÆ, 199

- Clupea, 199
- Clupea proper, 200
- Alosa, 201
- Chatoessus, 202
- Odontognathus, 202
- Pristigaster, 203
- Notopterus, 203
- Engraulis, 203
- Thryssa, 204
- Megalops, 204
- Elops, 204
- Butirinus, 204
- Chirocenthus, 205
- Hyodon, 205
- Erythrinus, 205
- Amia, 206
- Sudis, 206

II. ABDOMINAL MALACOPTERYGIANS—(*continued*).

Osteoglossum, 207

Lepisosteus, 207

Polypterus, 207

III. SUBBRACHIAN MALACOPTERYGIANS, 208

Fam. I. GADITES, 208

Gadus, 208

Morrhua, 209

Merlangus, 210

Merlucius, 210

Lota, 210

Motella, 211

Brosmius, 211

Brotula, 211

Phycis, 211

Raniceps, 212

Macrourus, 212

Fam. II. FLAT FISHES, 213

Pleuronectes, 213

Platessa, 213

Hypoglossus, 214

Rhombus, 215

Solea, 216

Monochirus, 216

Achirus, 217

Plagusia, 217

Fam. III. DISCOBOLI, 217

Lepadogaster, 217

Lepadogaster proper, 217

Gobieso, 218

Cyclopterus, 218

Lumpus, 218

Liparis, 218

Echeneis, 219

IV. APODAL MALACOPTERYGIANS, 220

Fam. I. ANGUILLIFORMES, 220

Muræna, 220

Anguilla, 220

True Eels, 221

Congers, 221

Ophisurus, 221

Muræna proper, 222

Sphagebranchus, 223

Monopterus, 223

Synbranchus, 223

IV. APODAL MALACOPTERYGIANS—(*continued*).

- Alabes, 224
- Sacchopharynx, 224
- Gymnotus, 224
- Gymnotus, 224
- Carapus, 225
- Sternarchus, 225
- Gymnarchus, 226
- Leptocephalus, 226
- Ophidium, 226
- Ophidium, 226
- Fierasfer, 227
- Ammodytes, 227

V. LOPHOBRANCHIATE FISHES, 228

- Syngnathus, 228
- Syngnathus, 229
- Hippocampus, 229
- Solenostomus, 229
- Pegasus, 230

VI. PLECTOGNATHES, 230

Fam. I. GYMNODONTES, 231

- Diodon, 232
- Tetraodon, 232
- Cephalus, 233
- Triodon, 234

Fam. II. SCLERODERMES, 234

- Balistes, 234
- Balistes, 234
- Monscanthus, 235
- Aluteres, 236
- Triacanthus, 236
- Ostracion, 237

SECOND SERIES.

CHONDROPTERYGIANS, OR CARTILAGINOUS FISHES.

I. STURIONES, CHONDROPTERYGIANS WITH FIXED GILLS, 238

- Accipenser, 238
- Polyodon, 240
- Chimœra, 240
- Chimœra, 240
- Callorhyncus, 241

II. FIXED GILLED CHONDROPTERYGIANS, 241

. *Fam. I. SELACHII.* 241

- Squalus, 242
- Scyllium, 242
- Squalus, 243
- Carcharias, 243
- Lamna, 244
- Galeus, 245
- Musletus, 245
- Selache, 245
- Cestracion, 246
- Spinax, 246
- Centrona, 246
- Scymnus, 247
- Zygæna, 247
- Squatena, 248
- Pristis, 248
- Raia, 248
- Raia, 248
- Rhinobatus, 249
- Rhina, 249
- Torpedo, 249
- Raia, 250
- Trygon, 251
- Anacanthus, 252
- Myliobates, 252
- Rhinoptera, 252
- Cephaloptera, 253

Fam. II. SUCTORII, 253

- Petromyzon, 254
- Petromyzon, 254
- Myxine, 255
- Heptatremus, 255
- Gastrobranchus, 255
- Ammocætes, 255

NOTE.

CORNISH FISHES, 256

Order I. Apodes, 256

II. Jugulares, 256

III. Thoracici, 257

IV. Abdominales, 257

Branchyostegous Fishes, 258

Chondropterygious Fishes, 258

NATURE OF FISHES.

Chapter I. General Character of Fishes, 259

Areas of Seas and Land, 259

II. Exterior of Fishes, 267

III. Osteology of Fishes, 269

IV. Myology of Fishes, 310

V. Brains and Nerves of Fishes, 322

VI. Organs of the external Senses in Fishes, 335

VII. Organs of Nutrition of Fishes, 352

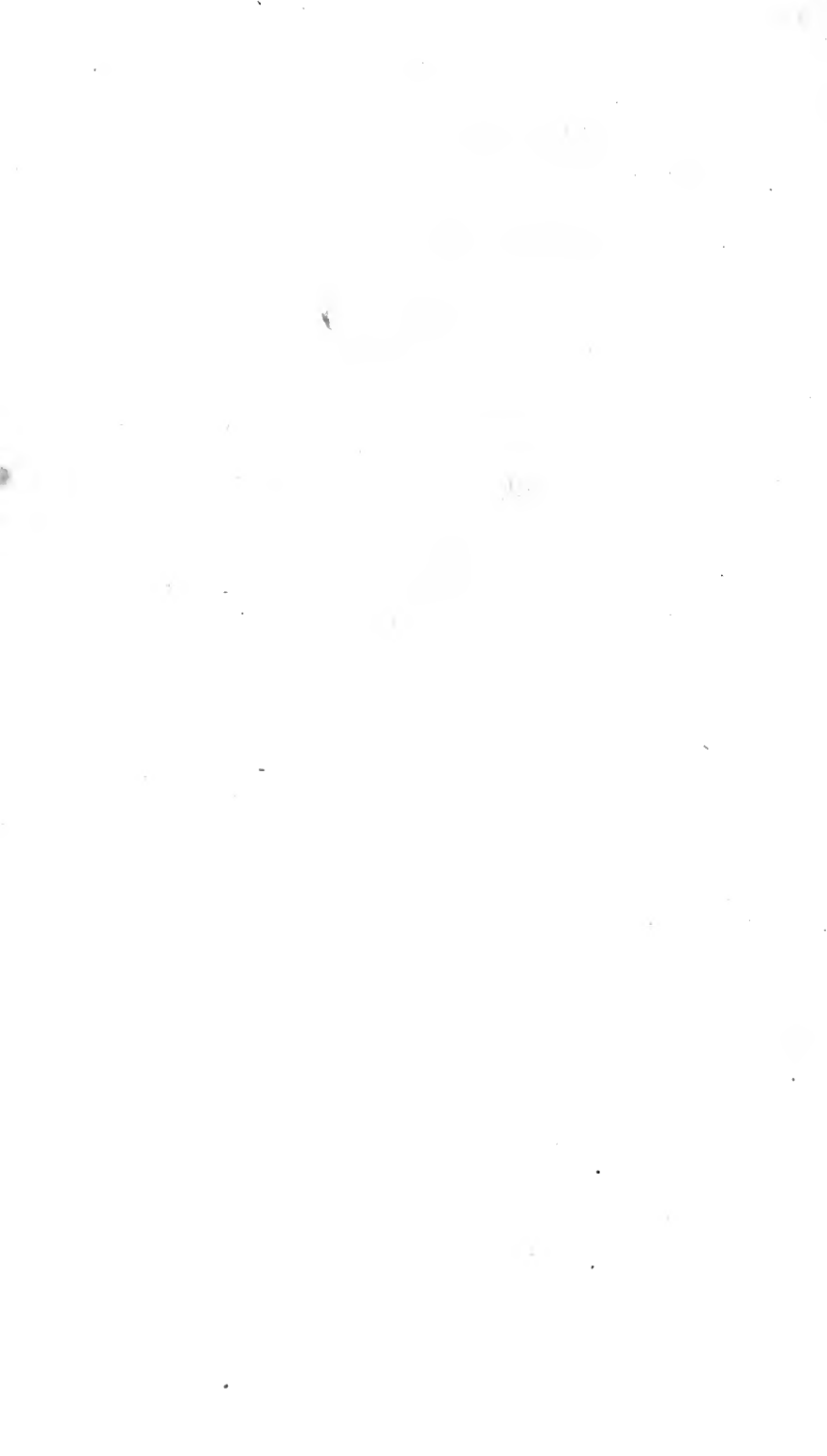
VIII. Organs of Generation of Fishes, 376

IX. General Recapitulation of the Organization of Fishes, 380

APPENDIX.

ANCIENT AND MODERN AUTHORS ON ICHTHYOLOGY, 393





THIRD GREAT DIVISION

OF

THE ANIMAL KINGDOM.

CLASS III.—VERTEBRATA.

REPTILES.

REPTILES have the heart so contrived as that, at each of its contractions, it transmits to the lungs a portion only of the blood which returns to it from the various parts of the body, and the remainder of this fluid goes back to circulate again, without having passed into the lungs, and consequently without having been subjected to respiration.

Hence it is, that the action of the oxygen on their blood is less than in the Mammalia, and that if the amount of respiration in the latter, in which all the blood is obliged to pass into the lungs before its return to the body, be represented by unity, then the amount of the respiration of the Reptiles may be expressed by a fraction of that unity, as small as the proportion of the blood sent into the lungs at each contraction of the heart.

As respiration is the source of the heat of the blood, and of the susceptibility of fibrous structure to nervous irritability, the reptiles having cold blood, and having a muscular power on the whole much inferior to that of the Quadrupeds, and *à fortiori*, than the Birds, they are incapable almost of other motions than those of crawling and swimming: and although several of them jump and run very fast at certain moments, yet their habits are slothful, their digestion excessively tedious, their sensations blunt, and in cold or temperate countries they pass the winter in a state of lethargy. Their brain, which is proportionally very small, is not so necessary to the exercise of their animal and vital faculties, as to the members of the two first classes; their sensations seem to be less referred to a common centre; they continue to live and to exhibit voluntary motions long after losing their brain, and even after their head has been cut off.

The connexion with the nervous system is also much less necessary to the contraction of their fibres, and their muscles preserve their irritability after being severed from the body much longer than those of the preceding classes; their heart continues to pulsate for hours after it has been torn away, nor does its loss prevent the body from moving for a long time. The cerebellum of several has been observed to be extremely small, a fact which tallies with their slight propensity to motion.

The smallness of the pulmonary vessels permits Reptiles to suspend the process of respiration without arresting the course of the blood; thus they dive with more facility, and remain longer under water than either the Mammalia or Birds. The cells of their lungs, being less numerous, because they have fewer vessels to lodge on their parietes, are much wider, and the organs themselves sometimes have the form of simple and scarcely cellular sacs.

Although some of them are incapable of producing audible sounds, they are all provided with a trachea and larynx.

Their blood not being warm, there was no necessity for teguments capable of retaining heat, so that they are covered with scales or simply with a naked skin.

The females have a double ovary and two oviducts; the males of several genera have a forked or double penis, those of the last order, the Batrachians, have none.

No Reptile hatches its eggs, and in several genera of the Batrachians, they are fecundated after their exclusion from the female, in which case the egg is enveloped by a membrane only. The young of this latter order, on quitting the egg, have the form and branchiæ of Fishes, and some of its genera preserve these organs even after the development of their lungs. In several oviparous Reptiles, the Colubers particularly, the young animal in the egg is formed and considerably advanced at the moment of its exit from the mother; and there are even some species which may be rendered viviparous by simply retarding that epoch*.

The quantity of respiration in Reptiles is not fixed like that of the Mammalia and Birds, but varies with the proportion of the diameter of the pulmonary artery compared to that of the aorta. Thus Tortoises and Lizards respire much more than Frogs, &c.; and hence results a much greater difference of sensibility and energy than can exist between one of the Mammalia and another, or between Birds.

Reptiles accordingly present an infinitely greater variety of forms, motions, and properties than is to be found in the two preceding classes;

* The Colubers, for instance, when deprived of water, as proved by the experiments of M. Geoffroy.

and it is in an especial manner in their production that Nature seems to have amused herself by imagining the most fantastic shapes, and by modifying in every possible way the general plan she has followed in the construction of the Vertebrated animals, and in the Oviparous classes especially.

The comparison, however, of their quantity of respiration and of their organs of motion, has enabled M. Brogniart to divide them into four orders*, viz.

The CHELONIA, or TORTOISES, whose heart has two auricles, and whose body, supported by four feet, is enveloped by two plates or bucklers formed by the ribs and sternum.

The SAURIA, or LIZARDS, whose heart has two auricles, and whose body, supported by four or two feet, is covered with scales.

The OPHIDIA, or SERPENTS, whose heart has two auricles, and whose body always remains deprived of feet.

The BATRACHIA, whose heart has but one auricle, and whose body is naked; most of these pass, with age, from the form of a fish breathing by branchiæ, to that of a quadruped breathing by lungs. Some of them, however, always retain their branchiæ, and a few have never more than two feet†.

ORDER I.

CHELONIA.—THE TORTOISES.

THE Chelonia, better known by the name of Tortoises, have a heart composed of two auricles, and of a ventricle divided in two unequal cavities, which communicate with each other. The blood from the body is poured into the right auricle, that from the lungs into the left, but the two streams become more or less mingled in passing through the ventricle.

These animals are distinguished at the first glance by the double shield in which the body is enveloped, and which allows no part to project except their head, neck, tail, and four feet. The upper shield, called *cara-*

* Al. Brogniart, *Essai d'une Classification Naturelle des Reptiles*, Paris, 1805, and in the *Mém. des Savants Etrang.*, tom. 1, p. 587.

† The Sauria and Ophidia are differently arranged by some others, Merrem, for instance. They detach the crocodiles, to form a separate order, and unite the first family of the Ophidia or Anguis to the remainder of the Sauria, a distribution which is founded on some peculiarities in the organization of crocodiles, and on a certain resemblance of Anguis to the Lizards. We merely indicate these affinities, which are almost wholly internal, preferring a division more easily applied.

pace, is formed by the ribs, of which there are eight pair, widened and reunited by denticulated sutures, and with plates adhering to the annular portion of the dorsal vertebræ, so that all these parts are rendered fixed and immoveable. The inferior shell, called *plastron*, is formed of pieces, usually nine in number, analogous to a sternum*. A frame, composed of bony pieces, which have been considered as possessing some analogy with the sternal or cartilaginous portion of the ribs, and which in one subgenus always remains in a cartilaginous state, surrounds the shell, uniting and binding together all the ribs which compose it. The vertebræ of the neck and tail are consequently the only ones which are moveable.

These two bony envelopes being immediately covered by the skin or by plates, the scapulæ and all the muscles of the arm and neck, instead of being connected with the ribs and spine, as in other animals, are attached beneath: the same arrangement is found in the bones of the pelvis and all the muscles of the thigh, so that in this respect the Tortoise may be said to be an *inverted* animal.

The vertebral extremity of the scapula is articulated with the shell; and the opposite limit, which may be considered analogous to a clavicle, is joined to the sternum; so that the two shoulders form a ring, through which pass the œsophagus and trachea.

A third bony branch, larger than either of the others, and directed downwards and backwards, represents, as in Birds, the coracoid apophysis, but its posterior extremity is free.

The lungs have considerable extent, and are situated in the same cavity with the other viscera†. The thorax, in most of them, being immoveable, it is by the play of its mouth that the Tortoise respire, the process being effected by keeping the jaws closed, and alternately raising and depressing the os hyoides. The former of these motions permits air to enter through the nostrils, the tongue then closes the internal orifice of those apertures, when the latter forces the air into the lungs‡.

Tortoises have no teeth; their jaws are invested with horn, like those of Birds,—the Chelydes, where they are covered with skin only, excepted. Their tympanum and palatine arches are fixed to the cranium, and are immoveable; their tongue is short and bristled with fleshy filaments; their

* See Geoff. An. du Mus. t. XIV, p. 5; and on the entire osteology of the tortoises, my Rech. sur les Oss. Foss. tom. V, 2e partie (a).

† Observe that in all those reptiles in which the lung penetrates into the abdomen (and the Crocodile is the only one in which it does not), it is enveloped like the intestines by a fold of the peritoneum, which separates it from the abdominal cavity.

‡ With respect to this mechanism, which is common to Tortoises and to the Batrachians, see the Mem. of Robert Townson, Lond. 1779.

§ (a) In future, the upper shell will be called "shell," and the inferior shell, "sternum."—ENG. ED.

stomach simple and strong; their intestines of a moderate length, and destitute of a cæcum. Their bladder is very large.

The penis of the male is simple and large, and the eggs laid by the female are invested with a hard shell. The former is frequently known by its exterior from the concavity of its sternum.

They possess great tenacity of life,—and instances are on record, in which they have been seen to move for several weeks after losing their head. They require but little nourishment, and can pass whole months, and even years, without eating.

The *Chelonia*, which were all united by Linnæus in the genus

TESTUDO, *Lin.*,

Have since been divided into five subgenera, chiefly from the forms and teguments of their shell, and of their feet.

1. LAND TORTOISES.—TESTUDO*, *Brog.*

The land Tortoises have the shell arched and supported by a solid, bony frame, most of its lateral edges being soldered to the sternum; the legs, as if truncated, with very short toes, which are closely joined as far as the nails, all susceptible of being withdrawn between the bucklers; there are five nails to the fore-feet, the hind ones have four, all stout and conical. Several species live on vegetable food.

T. græca, L.; Schœpf. pl. viii, ix, is the species most common in Europe; it is found in Greece, Italy, Sardinia, and apparently all round the Mediterranean. It is distinguished by its wide and equally arched shell; by its raised scales or plates, which are granulate in the centre, striated on the edges, and marbled with large yellow and black spots; and by its posterior edge in the middle, of which there is a prominence slightly bent over the tail. It rarely attains the length of a foot, lives on leaves, fruit, insects, and worms, excavates a hole in which it passes the winter, and breeds in the spring, laying four or five eggs similar to those of a Pigeon.

Among the species foreign to Europe, there are several from the East Indies, of an enormous size, and three feet, and upwards, in length. One of them in particular has been called the

Test. indica, Vosm.; Schœpf. Tort. pl. xxii. (The Indian Tortoise). Its shell is compressed in front, and its anterior edge is turned up above the head. Its colour is a deep brown.

Some of them are remarkable for the beautiful distribution of their colours; such are

T. geometrica, L.; Lacep. I, ix; Schœpf. x. (The Geometrica). A small tortoise, each plate of whose shell is regularly ornamented with yellow lines, radiating from a disk of the same colour.

T. radiata, Shaw, Gen. Zool. III, pl. ii; and Daud. II, xxvi.

* Merrem has changed this name into *CHERSINE*.

(The Coui). A New Holland species, ornamented with nearly as much regularity as the *Geometrica*, but which attains a much larger size*.

In some species, the *Pixys*, Bell., the anterior part of the sternum is moveable like that of the Box Tortoises; others again, the *Kinixys*, Id., can move the posterior portion†.

2. FRESH-WATER TORTOISES.—*Emys*‡, *Brongn.*

The fresh-water Tortoises have no other constant characters by which they can be distinguished from the preceding ones, than the greater separation of the toes, which are terminated by longer nails, and the intervals occupied by membranes; even in this respect there are shades of difference. They likewise have five nails before and four behind. The form of their feet renders their habits more aquatic. Most of them feed on insects, small fishes, &c. Their envelope is generally more flattened than that of the land tortoises.

Test. europæa, Schn.; *T. orbicularis*, L.; Schœpf. pl. 1 §, (The Fresh-water Tortoise of Europe), is the most universally diffused species; it is found in all the south and east of Europe and as far as Prussia. Its shell is oval, but slightly convex, tolerably smooth, blackish, and every where dotted with yellowish points arranged in radii. It attains the length of ten inches; its flesh is used as food, and it is reared for that purpose with bread, young vegetables, insects, &c. Marsigli says its eggs are a year in being hatched.

Test. picta, Schœpf. pl. iv, (The Painted Tortoise), is one of the most beautiful species; it is smooth and brown, each plate being surrounded with a yellow band, which is very broad on the anterior edge. It is found in North America along the shores of brooks, on rocks or trunks of trees, whence it plunges into the water on the first alarm||.

* Add, *T. stellata*, Schœpf. XXV;—*T. angulata*, Schweig;—*T. areolata*, Sch. XXIII;—*T. marginata*, Sch. XII, 1, 2;—*T. denticulata*, Sch. XXVIII, 1;—*T. cafra*, Schweig;—*T. signata*, Schw.;—*T. carbonaria*, Spix, XVI;—*T. Hercules*, Id. XIV;—*T. cagado*, Id. XVII;—*T. tabulata*, Sch. XIII;—*T. sculpta*, Spix, XV;—*T. nigra*, Quoy and Gaym. Voy. de Freycin. Zool. XXXVII;—*T. depressa*, Cuv.;—*T. biguttata*, Id.;—*T. carolina*, Le Conte, &c. (a).

† See the paper of M. Bell., in the Lin. Trans. Vol. XV, part 2, p. 392; in two of these *Kinixys* which we have seen living, the edges of the joint in the shield were worn away, or as if carious, and to such a degree as to induce a suspicion that there was something morbid in this conformation.

‡ From *emus*, tortoise.

§ It is the same as the *verte et jaune*, Lacep. pl. vi, and his *ronde*, pl. v; see the Monog. of this species by M. Bojanus, Vilna, 1819, fol.

|| Add, *Em. lutaria*, Lacep. IV;—*Em. Adausouii*, Schweig;—*Em. senegalensis*, Dumer.;—*Em. subrufa*, Lacep. XIII;—*Em. contracta*, Schweig;—*Em. punctata*, Schœpf. V;—*Em. reticulata*, Daud.;—*Em. rubriventris*, Le Conte;—*Em. serrata*, Daud. II, xxi;—*Em. concinna*, Le Conte, or *geometrica*, Lesueur;—*Em. geographica*, Lesueur;—*Em. scripta*, Schœpf. III, 4;—*Em. cinerea*, Id. II, 3;—*Em. centrata*, Daud. or *terrapen*, Lin. Schœpf. XV;—*Em. concentrica*, Le Conte;—*Em. odorata*, Id.;—*Em.*

Fig. (a) This is really the *T. carolina*, Gmel., the *T. polyphemus* of others.—Eng. Ed.

Among the fresh-water tortoises we should remark

THE BOX TORTOISES*,

The sternum of which is divided by a moveable articulation into two lids, which, when the head and limbs are withdrawn, completely encase the animal in its shell.

In some the anterior lid only is moveable †.

In others both are equally so ‡.

There are some fresh-water Tortoises, on the contrary, whose long tail and voluminous members cannot be completely retracted within the shell. These approximate, in this respect, to the following subgenera, and particularly to the Chelydes, and render them consequently worthy of distinction§. Such is,

Test. serpentina, L.; Schœpf. pl. vi, (The Snapper), which may be easily recognised by its tail, nearly as long as its shell, and bristled with sharp and dentated crests, and by its pyramidically elevated plates. It is found in the warm parts of North America, where it destroys numbers of fishes and aquatic birds, wanders far from rivers, and sometimes weighs upwards of twenty pounds.

3. THE SEA-TORTOISES.—CHELONIA||, Brongn.

The envelope of the Sea Tortoises is too small to receive their head, and particularly their feet, which are very long (the anterior ones most so), and flattened into fins, whilst their toes are all closely united in the same membrane. The two first ones of each foot being alone furnished with pointed nails, one or other of which at a certain age is very often lost. The pieces of their sternum do not form a continuous plate, but are variously notched, leaving considerable intervals, which are filled with cartilage only. The ribs are narrowed and separated from each other at their external extremities; the circumference of the shell, however, is surrounded with a circle of pieces corresponding to the ribs of the sternum. The temporal fossa is covered above by an arch formed by the parietal and other bones, so that the whole head is furnished with an uninterrupted osseous helmet. The internal surface of the œsophagus is

fusca, Lesueur;—*Em. leprosa*, Schw.;—*Em. nasuta*, Id.;—*Em. dorsata*, Schœpf.;—*Em. pulchella*, Schœpf. XXVI, or *insculpta*, Le Conte;—*Em. lutescens*, Schw.;—*Em. expansa*, Id.;—*Em. Macquaria*, Cuv.

M. Fitzinger separates under the name of CHELODINA, and M. Bell under that of HYDRASPIS, those species which have a more elongated neck, such as the *Em. longicollis*, Shaw, Gen. Zool. III, part I, pl. xvi;—*Em. planiceps*, Schœpf. XXVII, or *canaliculata*, Spix, VIII;—*Em. platicephala*, Merrem;—*Em. depressa*, Spix, III, 2;—*Em. carunculata*, Aug. St. Hil.;—*Em. tritenticulata*, Id.

* This subdivision gave Merrem his genus TERRAPEN, Spix his KINOSTERNON, and Fleming his CISTUDA. The European species, and others, already partake of this moveability, which renders the task of limiting the genus a difficult matter.

† *Test. subnigra*, I, vii, 2;—*T. clausa*, Schœpf. VII.

‡ *La Tortue à boîte d'Amboine*, Daud. II, 309;—*Test. tricarinata*, Schœpf. II;—*Test. pennsylvanica*, I, d. xxiv. [To which may be added *T. odorata*, Daud.]

§ This subdivision has furnished M. Fitzinger with his genus CHELYDRA, and M. Fleming with that of CHELONURA.

|| *Chelonia*, from *chelone*. Merrem has preferred the barbarous name of CARETTA.

every where armed with sharp cartilaginous points directed towards the stomach.

Test. mydas, L.*; *T. viridis*, Schn.; Lacep. I, 1, (The Common Turtle), is distinguished by its greenish plates, thirteen in number, which are not arranged like tiles; those of the middle range are almost regular hexagons. It is found from six to seven feet long, and weighing from seven to eight hundred pounds. Its flesh furnishes an agreeable and wholesome food to the mariner in every latitude of the torrid zone. It feeds in large troops on the sea-weed at the bottom of the ocean, and approaches the mouths of rivers to respire. The eggs, which it exposes on the sand to the sun, are very numerous, and excellent for eating; its shell is not employed in any useful purpose.

A neighbouring species, *Chel. maculosa*, Nob., the middle plates are twice as long as they are broad, and of a fawn colour, marked with large black spots. In a second, *Chel. lachrymata*, Nob., whose middle plates are similar to those of the *maculosa*, the last is so raised as to form a knob, and the fawn colour is marked with black streaks. The shell is employed in useful purposes.

Test. imbricata, (the Hawk-bill or Imbricated Turtle), L.; *Le Caret*, Lac. I, 11; Schœpf. XVIII, A. Smaller than the *viridis*, has a longer muzzle and denticulated jaws; there are thirteen fawn-coloured and brown plates, which overlap each other like tiles; its flesh is disagreeable and unwholesome, but the eggs are delicious, and it furnishes the finest kind of tortoiseshell employed in the arts. It inhabits the seas of hot climates.

There are also two species which approximate to the *imbricata*, *Chel. virgata*, Nob.; Bruce, Abyss., pl. xlii; whose plates are less elevated, the middle ones equal, but with more acute lateral angles, and marked in radii with black specks; and *Chel. radiata*, Schœpf. xvi, B, which only differs from the preceding in the increased breadth of the last middle plate; it is perhaps a mere variety.

Test. caretta, Gm.; *La Caouane*, Schœpf. pl. xvi; is more or less brown or red, and has fifteen plates, the middle ones of which are ridged, particularly towards their extremities; the point of the upper mandible is hooked, and the anterior feet are longer and narrower than in the neighbouring species, having two better marked nails. It is found in different seas, and even in the Mediterranean; it feeds on shell-fish; the flesh is not eaten, and its shell is of little value, but it yields good lamp-oil.

Merrem has recently distinguished, by the name of *SPHARGIS*, those *Chelonæ* whose shell is destitute of plates, and merely covered with a sort of leather†. Such is

Test. coriacea, L.; *Le Luth*, Lacep. I, iii; Schœpf. xxviii. (The

* This name of *Mydas* was taken by Linnæus from Niphus. Schneider considers it as a corruption of *emus*.

† Fleming calls them *CORIUDO*; Lesueur, *DERMOCHELIS*.

Coriaceous Turtle). A very large species of the Mediterranean (*a*). Its shell is oval and pointed behind, exhibiting three projecting longitudinal ridges *.

4. THE CHELYS, OR LARGE-MOUTHED TORTOISES.—CHELYS †, *Dumeril*.

The Chelys resemble fresh-water Tortoises in their feet and nails; their envelope is much too small to contain their head and feet, which are very large, and their nose is lengthened out into a small snout; their most marked character, however, consists in their mouth, which opens crosswise, being unarmed with the horny beak common to the other Chelonæ, and similar to that of certain Batrachians, the *Pipa* in particular.

Test. fimbria, Gm.; *La Matamata*, Bruguiere's Journ. d'Hist. Nat. I, xiii; Schœpf. xxi. The shell studded with pyramidal elevations, and the body edged all round with a pinked fringe. It is found in Guiana.

5. THE SOFT-SHELLED TORTOISES.—TRIONYX, *Geoff*.

The Soft-shelled Tortoises have no scales, the shell and sternum being simply enveloped by a soft skin; neither of those shells is completely supported by bones, the ribs not extending to the edges of the sternal one, and united with each other only for a portion of their length, the parts analogous to the sternal ribs being replaced by simple cartilage, and the sternal pieces partially notched as in the sea-tortoises, not covering the whole lower surface. After death, we can see through the dried skin that the surface of the ribs is very rough. Their feet, like those of the fresh-water Tortoises, are palmated without being lengthened, but only three of their toes are possessed of nails. The horn of their beak is invested externally with fleshy lips, and their nose is prolonged into a little snout. Their tail is very short, and the anal opening is pierced under its extremity. They live in fresh water, and the flexible edges of their shell aid them in swimming.

Trionyx ægyptiacus, Geoff. Ann. du Mus. XIV, 1; *Test. triunguis*, Forsk and Gmel. (The Tyrse, or Soft-shelled Tortoise of the Nile), is sometimes three feet in length, and of a green colour spotted with white; its shell is but slightly convex. It devours the young Crocodiles the moment they leave the egg, and is thus of more utility to Egypt than the Ichneumon ‡.

Test. ferox, Gm.; Penn. Phil. Trans. LXI, x, 1—3; cop. Lacep. I, vii; Schœpf. xix. (The Soft-shelled Tortoise of America), inhabits the rivers of Carolina, Georgia, the Floridas, and of Guiana. It remains in ambush under roots of reeds, &c. whence

* Add, *Dermochelis atlantica*, Lesueur.

† Merrem prefers calling this genus by the barbarous name of MATAMATA.


‡ Sonnini, Voy. en Egypte, tom. II, p. 333.

☞ (*a*) A large specimen of this species, caught on the coast of Devonshire, is to be seen in the British Museum.—ENG. ED.

it seizes birds, reptiles, &c., devours the young Alligators, and is devoured in turn by the old ones. Its flesh is good food* (a).

* Add, *Trionyx javanicus*, Geoff. Ann. du Mus. XIV;—*Tr. carinatus*, Id.;—*Tr. stellatus*, Id.;—*Tr. euphraticus*, Olivier, Voy. en Turquie, &c. pl. xlii;—*Tr. gangesicus*, Duvaucel;—*Tr. granosus*, Leach, or *Test. granosa*, Schæpf. xxx, A and B.

N. B. The *Tortue de Bartram*, Voy. Am. Sept. tr. fr. I, pl. 2, appears to me to be the *T. ferox*, to which, through a mistake, two nails too many have been added to each foot.

 (a) The Turtles form a very interesting feature in the very curious branch of Zoology connected with fossil animals. The remains which are found of them in the fossil state are, in general, portions of the bony skeleton. In the Tilgate Forest strata, remains have been found consisting altogether of bones, such as ribs, completely separated from the sternum and vertebræ, vertebræ isolated, portions of the sternum, pelvis, and of the femur, with the tibia, fibula, &c., and also of the humerus, with the radius, ulna, &c. These bones are of a dark brown colour, which may be accounted for by the iron with which they are strongly impregnated; and their specific gravity, which is considerable, is also a proof of the presence of iron; they are very brittle. The cellular nature of their structure, as seen in some specimens in the magnificent museum of MR. MANTELL, in Lewes, is displayed in a most interesting manner by the white substance (as carbonate of lime) which is injected, and which is in many specimens seen completely to occupy the medullary cavities of the long bones, such as the femur, humerus, &c. No considerable portion of the shell has been found.

Remains of a species of the soft-shelled Turtles, (*Trionyx*), have been also found in Tilgate Forest. Mr. Mantell, as a tribute of respect to Mr. Bakewell, the author of one of the most popular elementary works on Geology in the English language, gives it the name of *Trionyx Bakewelli*. Though the remains are undoubtedly traceable to this subgenus, yet it differs in some respects from the modern *Trionices*. Thus, the latter have the intervals between the ribs not ossified; their extremities are not articulated to an osseous border; their surface is shagreened—is marked with minute pits for attaching their only integument, the soft skin. They are without scales (see the early part of the description of *Trionyx* above), and on the bones accordingly, we find no marks of the margins of those scales which, in other subgenera, produce depressions and furrows. Now the fossil species, the *Trionyx Bakewelli*, has a shagreen surface like the modern soft-shelled Turtles, but it differs from them in having on several of its bones, as the rib and sternum, the impressions of a scaly covering.

Bones of a species of fresh-water Turtles were found by this justly celebrated geologist, (Mr. Mantell, of Lewes), in the beds of Tilgate Forest. This gentleman sent, a few years ago, some Sussex fossils of this species to Cuvier, which turned out to be portions of the sternum (carapace). Cuvier described them as portions of a flat but unknown species of the genus. Specimens very closely resembling it have been discovered in the Jura limestone near Soleure, and it corresponds with a specimen figured in the 5th vol. of Cuvier's grand work on the "Fossil Bones." But the species with plates and ribs are the most abundant in the Tilgate strata. Other bones have been likewise discovered, which are believed by Mr. Mantell to have belonged to the Marine Tortoises. The ribs in his Museum, which are supposed to be remains of these marine animals, have a smooth surface, are equal in width throughout their length, with extremities pointed, striated and marked with impressions of scales. There are also found in the strata of this forest, portions of a smooth osseous border, and sternal plates with margins either radiated or dentated. Mr. Mantell has recently received from Tilgate, a fine specimen of the third sternal plate of a Turtle, which bears a striking resemblance to that of *Testudo Imbricata*. From the numerous fragments of turtle bones preserved in the Museum of this meritorious naturalist, but which are too imperfect to form the foundation of any very decided conclusions, Mr. Mantell says, that this inference can, however, be drawn, that the strata of Tilgate contains the remains of at least three distinct kinds of Turtle, namely, a fresh-water species, *Trionyx*; an unknown species of *Emys*; and a marine species of the subgenus *Chelonina*.

The whole of the above remains have been found in the upper strata of the chalk formations, which constitute a portion of those called the Secondary Formations.—
ENG. ED.

ORDER II.

SAURIA*.—THE SAURIANS.

THE Saurian Reptiles have a heart like that of the Tortoises, composed of two auricles and one ventricle, which is sometimes divided by imperfect partitions.

Their ribs are moveable, are partially connected with the sternum, and can be raised or depressed in respiration.

Their lung extends more or less towards the posterior extremity of the body; it frequently penetrates very far into the lower part of the abdomen, the transverse muscles of which pass under the ribs, and even towards the neck, to clasp it. Those in which this organ is very large, possess the singular faculty of changing the colours of their skin according to the excitement produced in them by their wants or passions.

Their eggs are enveloped by a covering more or less hard, and the young emerge from them with the form which they permanently keep.

Their mouth is always armed with teeth, and their toes, with very few exceptions, are furnished with nails; their skin is covered with scales, more or less compact, or at least with scaly granules. They couple, either with two male organs or with one, according to their genera. They all have a tail more or less long, and generally very thick at its base: most of them have four legs, a few only having but two.

Linnæus included them all in two genera, the DRAGONS and the LIZARDS: but it has been found necessary to divide the latter into several, which so far differ in the number of feet, &c., the shape of the tongue, tail and scales, that we are even compelled to distribute them into several families.

FAMILY I.

CROCODILIDA.—THE CROCODILES,

Which contains only a single genus,

CROCODILUS, Br.

They have a considerable stature; their tail is flattened on the sides, five toes before and four behind, of which only the three internal ones on

* From the Gr. *sauros*, (lizard), animals analogous to Lizards.

each foot are armed with nails, all more or less united by membranes; a single range of pointed teeth in each jaw; the tongue fleshy, flat, and adhering close to its edges, a circumstance which induced the antients to believe that they had none; a single male organ, the anal opening longitudinal; the back and tail covered with very stout, large, square scales or plates, relieved by a ridge along their middle; a deeply notched crest on the tail, which is double at its base. The plates on the belly are smooth, thin, and square. Their nostrils, which open on the end of the muzzle by two small crescent-shaped fissures closed by valves, communicate with the extremity of the hind part of the mouth, by a narrow canal which traverses the palatine and sphenoidal bones.

The lower jaw being continued behind the cranium, the upper one appears to be moveable, and has been so described by the antients; it only moves, however, with the entire head.

Their external ear is closed by means of two fleshy lips, and there are three lids to their eyes. Under the throat are two small holes, the orifices of glands, from which a musk-scented pomatum issues.

The vertebræ of the neck rest on each other through the medium of small false ribs, which renders all lateral motion difficult, and does not allow these animals to deviate suddenly from their course; and it is easy to escape them by turning round them. They are the only Saurians that are destitute of clavicles, but their coracoid apophyses are attached to the sternum, as in all the others. In addition to the common and false ribs, there are others which protect the abdomen, without reaching to the spine, and which appear to be produced by the ossification of the tendinous insertions of the recti muscles.

Their lungs do not dip into the abdomen like those of other reptiles; and some muscular fibres, adhering to that part of the peritoneum which covers the liver, give them the appearance of a diaphragm, which, in conjunction with the division of their heart into three chambers, where the blood from the lungs does not mingle so perfectly with that from the body as in other reptiles, approximate them somewhat nearer to the hot-blooded quadrupeds.

The tympanum and pterygoid apophyses are fixed to the cranium as in the Tortoises. Their eggs are as large and hard as those of a Goose; and the Crocodiles are considered, of all animals, those which present the greatest difference in size. The females keep oareful watch over their eggs, and when hatched, tenderly protect their young for some months. They inhabit fresh water, are extremely carnivorous, cannot swallow under water, but drown their prey, and place it in some submerged crevice of a rock, where they allow it to putrify before they eat it*.

The species, which are more numerous than they were thought to be previous to my observations, are referable to three distinct subgenera.

THE GAVIALS, *Cuv.*,

Have the muzzle slender and very long; the teeth nearly equal; the

* Crocodiles differ so much from Lizards, that several authors have recently thought it proper to form them into a separate order. They are the LORICATA, Merrem and Fitzinger; the EMYDOSAURIA, Blainv.

fourth ones below passing, when the jaws are closed, into notches, and not into holes in the upper one; the external edges of the hind feet are notched, and the feet themselves palmated to the very ends of the toes; two large holes in the bones of the cranium behind the eyes may be felt through the skin. They have as yet been found only in the antient continent. The most common is

Lac. gangetica, Gm.; *Gavial du Gange*, Faujas. Hist. de la Mont. de St. Pierre, pl. xlvi; Lacep. I, xv. A species which attains a great size, and which, besides the length of its muzzle, is remarkable for a stout cartilaginous prominence which encircles its nostrils, and then inclines backwards*.

CROCODILES†, properly so called,

Have an oblong and depressed muzzle, unequal teeth, the fourth ones below passing into notches, and not into holes of the upper jaw, and all the remaining characters of the preceding subgenus. They are found in both continents.

Lac. crocodilus, L.; *Crocodile du Nil.*, Geoffr. Descr. de l'Egypte, Rep. II, 1; Ann. Mus. X, iii, 1; Cuv. Ib. X, pl. 1, f. 5 and 11, f. 7, and Oss. Foss. V, part 2, same plate and figure, (The Common Crocodile, or Crocodile of the Nile), so celebrated among the antients, has six rows of square and nearly equal plates along the whole length of the back‡.

* This prominence is the foundation of Ælian's remark (Hist. an. LXII, c. 41), that the Ganges produces Crocodiles which have a horn on the end of the muzzle. See its figure and description by Geoff. St. Hilaire, Mém. du Mus. XII, p. 97.

Add, the *Petit Gavial* (*Croc. tenuirostris*, Cuv.), Faujas. loc. cit. pl. xlviii, should it prove to be a distinct species.

N.B. The calcareous schist of Bavaria has produced a small fossil Gavial of a peculiar species, described by Sæmmering in the Mém. of the Acad. of Munich, of 1814.

I have described the crania and other parts of fossil Crocodiles allied to the Gavials found at Caen, Honfleur, and other places, and marked those points in which the osteology of their cranium differs from that of the Gavial now in existence. See Oss. Foss. V, part 2. Similar observations have also been made in England, by M. Conybeare. In consequence of these differences, which all relate to the hind part of the palate, M. Geoffroy has thought proper to form two genera of these lost animals, which he calls THELEOSAURUS and STENEOSAURUS, notwithstanding which, he appears to think that the living Gavials may have descended from them, and that the differences between them may have resulted from atmospheric changes. Mém. du Mus. XII.

† *Krokodeilos*, which fears the shore, a name given by the Greeks to a common Lizard of their country; they afterwards, in their travels through Egypt, applied it to the Crocodile from the mutual resemblance. Herodot. Lib. II. Merrem has changed the name of this subgenus to that of CHAMPSSES, which, according to Herodotus, was the Egyptian name of this animal.

‡ From the Senegal to the Ganges, and beyond it, we find Crocodiles very similar to the common one, some of which have a rather longer and narrower muzzle, and others, a difference in the plates or scales which cover the top of their neck; but it is very difficult to arrange them as distinct species, on account of their intermediate gradations. The small insulated scales which form a transverse row immediately behind the cranium, vary from two, to four and six; the approximated scales which compose the shield of the neck are generally six in number, but sometimes there is a smaller one at but little distance from each of the anterior angles of this shield, and at others it is contiguous to it, in which case it (the shield) consists of eight

Croc. biporcatus, Cuv.; *Le Crocodile à deux arêtes*, Ann. Mus. X, 1, 4 and 11, 8, and Oss. Foss. V, 2d part, same plates and fig., has eight rows of oval plates along the back, and two projecting crests on the upper part of the muzzle. It is found in several islands of the Indian Ocean, and most probably exists in the two peninsulas.

Croc. acutus, Cuv.; *Crocodile à museau effilé*, Geoff. Ann. Mus. II, xxxvii, has a longer muzzle, arched at base; the dorsal plates arranged in four lines; the external ones disposed irregularly, and with more salient ridges. From St. Domingo and the other great Antilles. The female places her eggs under ground, and uncovers them at the moment they are about to be hatched*.

ALLIGATOR†, Cuv.

Alligators have a broad obtuse muzzle and unequal teeth, the fourth

plates or scales. M. Geoffroy calls those which have a longer and narrower muzzle, *Croc. suchus*; those whose row of scales behind the cranium consists of six pieces, *Croc. marginatus*, among which some have six plates in the shield, and others eight; *Croc. lacunosus*, an individual specimen which only presented two scales behind the cranium, and six plates in the shield; and, finally, another specimen whose characters are referable to some proportions of the head, *Croc. complanatus*.

These various Crocodiles also differ in some of the details of the form of the muzzle, and in the lateral scales of the back, but as regards this, and the muzzle particularly, the varieties are still more numerous, and M. Geoffroy acknowledges that *nothing is more fugitive than the forms of Crocodiles*. This is so much the case, that I dare not elevate the Crocodiles sent from Bengal by M. Duvaucel to the rank of species, although they have a more convex head than any of the others.

There is another point in which I am compelled to differ from the learned naturalist I have just quoted. He supposes that the variety or species with the narrow muzzle remains smaller, is gentle and inoffensive, and that the smallness of its size causes it to be soonest thrown upon the shores by inundations, of which it is thus the precursor, and, from these ideas, is of opinion that it was the object of the religious honours of the Egyptians, and that *Suchus*, or *Suchis*, was its specific spallation. On the contrary, I think I have proved, both by Aristotle and Cicero, that the Crocodiles venerated by the Egyptians were not less ferocious than the others; it is also very certain, that the species with the narrow muzzle was not the exclusive object of priestly care, for, from the very exact researches of M. Geoffroy himself, it appears that the three embalmed Crocodiles now in Paris are not the *Suchus*, but the *complanatus*, the *marginatus*, and the *lacunosus*; in fine, I am forced to believe that *Souc*, or *Souchis*, which, according to M. Champollion, was the Egyptian name of Saturn, was also the specific name of the Crocodile fed at Arsinoë, just as *Apis* was the name of the sacred bull at Memphis, and *Mnevis* that of the bull of Hermopolis. With respect to this point of antient history, see the various writings of M. Geoffroy, and particularly in the great work on Egypt, as well as my Oss. Foss. tom. V. part 2, p. 45. This last article having been written previous to that of the great work on Egypt, I could not profit by the argument drawn from the difference of the embalmed Crocodiles, an argument furnished me by M. Geoffroy, and one which seems to me strongly to corroborate my view of the matter.

* The *Croc. acutus* has been particularly observed by M. Descourtils.—Add, the *Croc. rhombifer*, Cuv. Ann. Mus. XII, pl. 1, 1;—the *Croc. à casque* (*C. galeatus*), Perrault, Mém. pour servir à l'Hist. des An. pl. lxiv, if it should prove (being only known by this figure) a constant species;—the *Croc. bisgutatus*, Cuv. Ann. Mus. X, 11, 6, and Oss. Foss. t. V, part 2, pl. 11, f. 6. of which only one or two specimens have ever been seen;—the *Croc. cataphractus*, Cuv. Oss. Foss. V, part 1, pl. v, f. 1 and 2.

† Or *Caïman*, the name given to Crocodiles by the negroes of Guinea. The French colonists employ it to designate the species of Crocodile most common about

lower ones entering into holes in the upper jaw, and not into notches; their feet are only semi-palmate and without emargination. They have hitherto only been certainly found in America.

Croc. sclerops, Schn.; Seb. I, civ, 10; Cuv. Ann. Mus. X, 1, 7, and 16 and 11, 3, (The Spectacle Alligator), so named from a transverse ridge, which unites in front the salient borders of its orbits, is the most common species in Guiana and Brazil. Its neck is defended by four transverse bands of strong plates. The female lays in the sand, covers her eggs with straw or leaves, and defends them courageously*.

Croc. lucius, Cuv.; *Caïman à museau de brochet*, Ann. Mus. X, 1, 8, and 15, and II, 4, (The Pike Alligator), so called from the shape of its muzzle, is also distinguished by four principal plates on its neck. It inhabits the southern parts of North America, forces itself into the mud, and remains torpid in severe winters. The female deposits her eggs in alternate layers with beds of earth † (a).

their plantations. The word *Alligator* is used by the English and Dutch colonists in the same sense. It is a corruption of the Portuguese word *Lagarto*, which is itself derived from *Lacerta*.

* There are also several sorts of Caïmans or Alligators, which have this transverse ridge front of the orbits, and which, like the Crocodiles, allied to the common one, perhaps form distinct species, but difficult to characterize.


Some of them have a shorter and more rounded muzzle; the transverse ridge concave before, and extending to the cheek on each side. They have thirteen teeth on each side above; their cranium is not widened behind; their body is green dotted, and spotted with black, with black bands on the tail.

Others have the same kind of head, and the same teeth, but their body is black, with narrow bands that are yellowish, as in the *Jacaré noir*, Spix, pl. iv.

Others, again, have a muzzle less broad, and the concave ridge does not extend so far; they have fifteen teeth, and their neck is more completely defended by plates; I should willingly consider them as the *Cr. fissipes* of Spix, pl. iii.

Finally, there are some with a still narrower muzzle, and the cranium somewhat widened behind, whose transverse ridge is convex in front, and does not extend on the cheek; the ridge of their dorsal plates is less salient, and the bands on their tail are more faintly marked: can they be the *Cr. punctulatus* of Spix, pl. ii? That gentleman, unfortunately, has not insisted upon the characters drawn from the transverse ridge.

† See, on this species, the paper of Dr. Harlan, Ac. of Nat. Sc. of Philad. IV, 242.—Add, the *Caïman à paupières osseuses* (*Croc. palpebrosus*, Cuv.), Ann. Mus. X, pl. 1, 6 and 7, and 11, 2; and the *Croc. trigonatus*, Schn., Seb. I, cv, 3; or the *Jacaretinga moschifer*, Spix, pl. i. The whole thickness of the eye-lid, in this species, is occupied by three osseous lamellæ, of which, in other Crocodiles, there is scarcely a vestige.

 (a) Fossil remains of Crocodiles are found in the Secondary formations of the south-east of Sussex, and in each of the series composing these formations, from the Oolite to the Chalk, both included. The Tertiary deposits likewise contain them. Some teeth found in Tilgate Forest, by Mr. Mantell, have all the essential characters of those of living Crocodiles, and they are calculated by that experienced geologist to have belonged to animals between twenty and thirty feet long. The fragments of the bones of Crocodiles, in the possession of Mr. Mantell, are those of at least two species, if not of four. They consist of teeth, scales, vertebræ, ribs, and other bones. Teeth of fossil Crocodiles are also abundant in the Wealden formation, resembling those of the Jura limestone, and those of the Gavials.—ENG. ED.

FAMILY II.

LACERTINIDA*.—THE LIZARDS.

THIS family is distinguished by its thin extensible tongue, which terminates in two threads, like that of the Coluber and Viper; their body is elongated; their walk rapid; each foot has five toes armed with nails, separate and unequal, the hind ones particularly so; the scales beneath the belly and round the tail are arranged in transverse and parallel bands; the tympanum is level with the head, or but slightly sunk, and membranous. A production of the skin with a longitudinal slit which is closed by a sphincter, protects the eye, under whose anterior angle is the vestige of a third eye-lid; the false ribs do not form a complete circle; the male organs of generation are double, and the anus is a transverse slit.

The species being very numerous and various, we subdivide them into two great genera.

THE MONITORS, *recently denominated, by a singular error,*
TUPINAMBIS†,

Are those in which the species are of the largest size; they have two teeth in both jaws, but none in the palate; the greater number are recognized by their laterally compressed tail, which renders them more aquatic. The vicinity of water sometimes brings them in the neighbourhood of Crocodiles and Alligators, and it is said that by hissing they give notice of the approach of these dangerous reptiles. This assertion is most probably the origin of the term *Safeguard* or *Monitor*, applied to some of their species, but the fact is not the less certain. They are divided into two very distinct groups. The first, or that of the

MONITORS, *properly so called,*

Is known by numerous and small scales on the head and limbs, under the belly and round the tail; on the top of the latter is a carina formed by a double row of projecting scales. The range of pores observed on the thighs of several other Saurians is not found in these. They are all from the eastern continent‡. Two species are found in Egypt, which may be considered as the types of two subdivisions.

* *Lacerta*, a Lizard.

† Marcgrave, speaking of the Sauvegarde of America, says that it is called *Teyugauçu*, and among the Tupinambous, *Temapara* (*Temapara tupinambis*). Seba has mistaken the latter name for that of the animal, and all other naturalists have copied it from him.

‡ Seba, and from him Daudin, describe some true Monitors as American; it is a mistake.

Lac. nilotica, L.; *Monitor du Nil*; *Ouaran* of the Arabs; Mus. Worm. 313; Geoff. St. Hil. great work on Egypt, Rep. pl. 1, f. 1. (The Monitor of the Nile). Strong conical teeth, the posterior of which become rounded by age; brown, with pale and deeper coloured dots, forming various compartments, among which we observe transverse rows of large ocellated spots that become rings on the tail. The latter, round at the base, is transversed above by a carina, which extends almost from root to tip. It attains a length of five and six feet. The Egyptians pretend it is a young Crocodile hatched in a dry place. It was engraved upon the monuments of that country by its antient inhabitants, and, possibly, because it devours the eggs of the Crocodile*. The other species,

Lac. scincus, Merr.; *Le Monitor terrestre d'Egypte*; *Ouaran el hard* of the Arabs, Geoff. Egypt. Rept. III, f. 2, (The Great Ouran), has compressed, trenchant, and pointed teeth; the tail almost without a keel, and round much farther from the root; its habits are more terrestrial, and it is common in the deserts in the vicinity of Egypt. The jugglers of Cairo, after extracting its teeth, employ it in their exhibitions. It is the *Land Crocodile* of Herodotus, and, as Prosper Albin remarks, the true *Scincus* of the antients†.

India and Africa produce a great number of Monitors with trenchant teeth like those of the preceding species, but whose tail is more compressed than even that of the *Monitor of the Nile*. The one most common in the Indian Archipelago, is the

Lac. bivittata, Kuhl. (The Two-banded Monitor), which is white above, black beneath, with five transverse rows of white spots or rings. A white band extends along the neck, and there is an angle formed by the white on the breast, which reaches obliquely over the shoulder. Specimens have been found three feet in length‡.

The other group of Monitors possesses angular plates on the head,

* To this species, both by the form of the teeth and the arrangement of the spots, which, by the bye, are similar in almost all the Monitors, must be referred the *M. orné* (*M. ornatus*, Daud.), Ann. Mus. II, xlviii, *Lac. capensis*, Sparm., and the *M. albogularis*, Daud. Rept. III, pl. xxxii.

† It is from this subdivision that M. Fitzinger has made his genus *VARANUS*, under which name Merrem comprised all the Monitors.

‡ This species constitutes the genus *PSAMMOSAURUS* of M. Fitzinger.

§ To this species, from the form of the teeth and the distribution of colours, must be attached the *T. bigaré*, Daud. (*Lac. varia*, Shaw, Nat. Misc. 83, J. White, 253);—a neighbouring species of Manilla (*M. marmoratus*, C.);—the *T. elegant* and the *T. étoilé*, Daud. III, xxxi, and Seb. I, xciv, 1, 2, 3, xcviii, xcix, 2; II, xxx, 2, xc, cv, 1, &c., all of which are but one species, originally from Africa. We must add, the *T. cepedien*, Daud. III, xxiv, or *Lac. exanthematica*, Bosc. Act. Soc. Nat. Par. pl. v, f. 3, ocellated throughout;—the *M.* dotted with brown of Bengal (*M. bengalensis*, Daud.); the black *M.* spotted with green of the Moluccas (*M. indicus*, Daud.);—a species of a uniform black from Java (*M. nigricans*, Cuv.), &c.

All things considered, I have now reason to believe that the fig. of Seba, I, pl. ci, f. 1, of which Linnæus made his *Lacerta dracæna*, but which is very different from the *Dragonne* of Lacep., is the *M. bengalensis*. Seba's original is in the Museum.

To these species with a compressed tail, M. Fitzinger applies the generic name of *TUPINAMBIS*.

and large rectangular scales on the belly and round the tail. The skin of the throat, covered with small scales, is doubled into two transverse folds. There is a row of pores on the under part of their thighs*. This group is also susceptible of subdivisions: the first forms

CROCODILURUS†, Spix,

Which have, for their distinguishing character, scales relieved by ridges, as in the Crocodiles, forming crests on the tail, which is compressed.

Mon. crocodilinus, Merr.; *La Grande Dragonne*, Lacep. Quadr. Ovip. pl. ix, (The Great Dragon), has ridged scales scattered also along the back. Its back teeth become rounded with age. It attains a length of six feet, and lives in Guiana, in burrows near marshes: its flesh is eaten.

Lac. bicarinata, L.; *Le Lezardet*, Daud.; *Crocodylus amazonicus*, Spix, pl. xxi, is smaller, and has none of the aforesaid kind of scales on the back. It is found in several parts of South America. The second, the

SAFEGUARDS—SAUVEGARDES, Cuv.,

Have all the scales of the back and tail carinate: the teeth are notched, but with age the back ones also become rounded‡.

Some of them, more particularly termed SAFEGUARDS, have a tail that is more or less compressed; the scales on the belly are longer than they are broad. They live on the banks of rivers, &c. Such in particular is

Lac. teguixin, Lin. and Shaw, (the Great Safeguard of America); the *Teyu-quazu*; *Témapara*, &c.; Seb. I, xcvi, 1, 2, 3, xcvi, 5, xcix, 1, has yellow dots and spots disposed in transverse bands, on a black ground above, and a yellowish one beneath; yellow and black bands on the tail§. In Brazil and Guiana it attains the length of six feet. It moves rapidly on shore, and when pursued hastens to the water for refuge, where it dives, but does not swim. It feeds on all sorts of insects, reptiles, eggs, &c., and lays in holes which it excavates in the sand. Both flesh and eggs are edible||.

Others, called AMEIVAS¶, only differ from the preceding in the tail,

* Merrem has made his genus *TEIUS* from this second group.

† M. Gray has changed this name into *ADA*.

‡ It is to such that M. Fitzinger particularly applies the name of *MONITOR*.

§ Dried specimens, or those preserved in spirits, assume a greenish or bluish tint in those parts where the colours are light, and it is thus that they are represented by Seba; but while alive, and as we have seen it, the light parts are more or less yellow. Pr. Max. de Wied has given a good picture of it in his eleventh No.

|| Add the *Tupin. à taches vertes* of Daud., if it be not a simple variety of *Sauvegarde*. Spix calls it *Tup. monitor*, pl. xix; it is his. *T. nigropunctatus*, which is the true *Sauvegarde*.

¶ According to Maregrave, the term *Ameiva* designates a Lizard with a forked tail, a circumstance which can only be the result of accident; Edwards having had in his possession an individual of the above division, in which this accident was observed, applied that term to the whole species. Maregrave compares his individual to his *Taraguira*, which, from his description, is rather a *Polychrus*.

which is round, and nowise compressed, furnished, as well as the belly, with transverse rows of square scales; those on the belly are more broad than long. They are American Lizards, tolerably similar, externally, to those which represent them in Europe; but besides the want of molars, most of them have no collar, and all the scales of the throat are small; their head also is more pyramidal than that of the European Lizards, and they have not, like the latter, a bony plate on the orbit.

Several species have been confounded under the name of *Lacerta ameiva*, some of which it is still very difficult to distinguish. The most common, *Teyus ameiva*, Spix, XXIII; Pr. Max. de Wied. liv. V, is a foot long or more; green; the back more or less dotted and spotted with black, and vertical rows of white ocellated spots bordered with black, on the flanks.

There is another, *Teyus cyaneus*, Merr.; Lacep. I, xxxi, Seb. II, cv, 2, about the same size, of a bluish colour, with round white spots scattered over the flanks and sometimes on the body. The young of these animals, and of some others of the same subdivision, have blackish stripes on the sides of the back, a fact worth remembering to avoid an undue multiplication of species*.

We may separate from the Ameivas certain species, all the scales of whose belly, legs, and tail, are carinated†, and others in which even those on the back are similarly relieved, so that the flanks only are granulated‡. A collar under the neck also approximates these species to the lizards§.

THE LIZARDS, properly so called,

Form the second genus of the Lizards. They have the bottom of their palate armed with two rows of teeth, and they are otherwise distinguished

* Such, it appears to me, is the *Teyus ocellifer*, Spix, xxv.

Add the *Am. litterata*, Daud. Seb. I, lxxxiii;—*Am. cæruleocephala*, Id. Seb. I, xci, 3;—*Am. lateristriga*, Cuv. Seb. I, xc, 7;—*Am. lemniscata* (*Lacert. lemnis*, Gm.), Seb. I, xcii, 4;—*Teius tritaniatus*, Spix, xxi, 2;—*T. cyanomelas*, Pr. Max. Liv. v. [Add, *Am. sex-lineata*, Catesb. 68.—ENG. ED.]

It is impossible to say from what confusion of synonymes Daud. has placed the *Am. litterata* in Germany; like all the others, it is from America. The *Am. graphique*, Daud. Seb. I, lxxxv, 2, 4, is the Dotted Monitor; his *Am. argus*, Seb. I, lxxxv, 3, is the *Mon. cepedian*; his *goitreux*, Seb. II, ciii, 3, 4, does not differ from the *litterata*; finally, his *tête rouge*, Seb. I, xci, 1, 2, is a common Green Lizard. He was probably led into error by the coloured plates of Seba. The *Lac. 5-lineata* appears to me to be a *L. cæruleocephala*, a part of whose broken tail had grown again with small scales, as is always the case when that accident happens; the axis of this new portion of the tail is always, also, a cartilaginous stem without vertebræ. It is impossible to characterize species by similar accidental circumstances, as Merrem has done in his *Teyus monitor* and *cyaneus*.

† In one sex of one of these species, there are two small spines on each side of the anus, which circumstance gave rise to the genus *CENTROPYX* of Spix, XXII, 2.

‡ The *Lézard strié* of *Surinam*, Daud. III, p. 347, of which Fitzinger makes his genus *PSEUDO-AMEIVA*.

§ It appears to me that even the *Centropyx* has palatine teeth; these two sorts of Lizards, however, have the head of an Ameiva, no bone on the orbit, &c. N.B. Fitzinger makes a genus (*TEYUS*) of the *Lézard teyou*, Daud., which should have but four toes to the hind feet; its only foundation, however, is an imperfect description of Azzara, and it does not seem to me sufficiently authentic.

from the Ameivas and Safeguards by a collar under the neck, formed of a transverse row of large scales, separated from those on the belly by a space covered with small ones only, like those under the throat; and by the circumstance that a part of the cranium projects over their temples and orbits, so as to furnish the whole top of the head with a bony buckler.

They are very numerous, and our country produces several species confounded by Linnæus under the name of *Lacerta agilis*. The most beautiful is the *Grand Lézard vert ocellé*,—*Lac. ocellata*, Daud.; Lacep. I, xx; Daud. III, xxxiii; from the south of France, Spain, and Italy. (The Ocellated Lizard). It is more than a foot long, of a beautiful green, with lines of black dots, forming rings or eyes and a kind of embroidery; the young, according to Milne Edwards, is the *Lezard gentil*, Daud. III, xxxi. The *Lac. viridis*, (The Green Lizard), Daud. III, xxxiv, of which the *Lac. bilineata*, Id. xxxvi, 1, according to the same gentleman, is a variety;—the *Lac. sepium*, Id. Ib. 2, of which the *Lac. arenicola*, Id. xxxviii, 2, is a variety;—and the *Lac. agilis*, Id. xxxviii, 1, are found in the environs of Paris. The south of France produces the *Veloce*, Pall., to which must be referred the *Bosquien*, Daud. xxxvi, 2, and some new species*.

THE ALGYRES—ALGYRA, Cuv.

Have the tongue, teeth, and femoral pores of the Lizards, but the scales of the back and tail are carinated, those of the belly smooth and imbricated. The collar is wanting†.

THE TACHYDROMES, OR SWIFT LIZARDS—TACHYDROMUS‡, Daud.

Have square and carinated scales on the back, under the belly, and on the tail; neither collar nor femoral pores, but on each side of the anus is a small vesicle opening by one pore. The tongue is still like that of the Lizards, and the body and tail are very much elongated.

FAMILY III.

THE IGUANAS.—IGUANIDÆ.

All the family of Saurians possess the general form, long tail, and free and unequal toes of the Lizards; their eye, ear, penis, anus, are simi-

* I add, but with hesitation, the *Lac. cericea*, Laur. 11, 5; *argus*, Id. 5; *terrestris*, Id. III, 5. The *tiliguerta* of Daudin is made up of an American Ameiva and the green Lizard of Sardinia, from a bad description by Cetti. The *cæruleocephala*, the *lemniscata*, the *quinguelincata*, are Ameivas. The *sexlineata*, Catesb. XLVIII, is a Seps.

N.B. With due submission to our author, this appears to be a mistake, the *sexlineata*, Catesb., is most certainly an Ameiva.—ENG. ED.

† *Lac. alegyra*, Lin.

‡ *Tachus* and *dromon*, (Gr.), Quick-runner.

§ *Iguane*, a name according to *Hernandéz*, *Scaliger*, &c. originating in St. Domingo,

lar, but their tongue is fleshy, thick, non-extensible, and only emarginated at the tip.

We may divide them into two sections; the first, or that of the AGAMIANS, have no palatine teeth. In this section we place the following genera,

THE STELLIONS—STELLIO, *Cuv.*

Which have, with the general characters of the family of the Iguanida the tail encircled by rings composed of large and frequently spiny scales. The subgenera are as follows:

CORDYLUS*, *Gronov.*

The tail, belly, and back covered with large scales arranged in transverse rows. The head, like that of the common lizards, is protected by a continuous bony buckler, and covered with plates. In several species the points of the scales on the tail form spiny circles; there are small spines also to those on the sides of the back, on the shoulders, and out-sides of the thighs, on which latter there is a line of very large pores.

The Cape of Good Hope produces several species long confounded under the name of *Lacerta cordylus*, L. These Saurians, whose armour so completely defends them, are a little larger than the common Green Lizards of Europe, and feed on insects†.

STELLIO‡, *Daud.*

The Stellios have the spines of the tail moderate: the head enlarged behind by the muscles of the jaws; the back and thighs bristled here and

whose inhabitants must have pronounced it *Huana*, or *Igoana*. According to Bontius it originated in Java, where the natives call it *Leguan*. In this case the Portuguese and Spaniards carried it to America transformed to *Iguana*. They apply it there now to a *Sauvegarde*, as a true *Iguana*. This name, as well as that of *Guano*, has occasionally been given to Monitors of the eastern continent. The reader of travels should bear this in mind; I even consider the *Leguan* of Bontius as a Monitor.

* According to Aristotle, "the *Cordylus* is the only animal possessing feet and branchiæ. It swims with its feet and tail, the latter of which, as far as large things can be compared with small, is similar to that of a *Silurus*. This tail is soft and broad. It has no fins: it lives in marshes, like the Frog: it is a quadruped, and leaves the water: sometimes it is dried up and dies."

It is evident that these characters can only belong to the larva of the aquatic Salamander, as M. Schneider has very justly observed. Belon has described this Salamander by the name of *Cordyle*, but his printer, by mistake, annexed to it the figure of the *Lac. nilotica*, L. Rondelet has applied this name to the great *Stellio* of Egypt, or *Caudiverbera* of Bélon, mistaking the ear, in the figure, for a gill opening. Between Rondelet and Linnaeus, then, *Cordylus* has passed for the synonymes of the *Caudiverbera*. Its special application to the above subgenus is altogether arbitrary. Merrem has changed it to ZONURUS.

† Daudin has referred several synonymes of Stellio to Cordylus, just as he has referred to Stellio several synonymes of the *Geckotte*. There are four species in France: *Cord. griseus*, Nob. Seb. I, lxxxiv, 4;—the *C. niger*, the ridges of whose scales are more blunt, Seb. II, lxii, 5;—the *C. dorsalis*;—the *C. microlepidotus*.

There are also some Cordyles at the Cape of G. Hope, whose scales (even those on the tail) are almost destitute of spines (*C. laevigatus*, Nob.)

‡ The Stellio of the Latins was a spotted Lizard that lived in holes of walls. It was considered the enemy of man, venomous and cunning. Hence the term *stellio*—

there with scales larger than the others, and sometimes spiny; small groups of spines surrounding the ear; no pores on the thighs; the tail long, and terminating in a point. But one species is known.

Lac. stellio, L.; the Stellio of the Levant; Seb. I, cvi, f. 1, 2; and better Tournef. Voy. au Lev. I, 120; and Geoff. Descr. de l'Egypte, Rept. II, 3; *Koscordylos*, of the modern Greeks; *Hardun* of the Arabs. (The Common Stellio). A foot long; of an olive colour shaded with black; very common throughout the Levant, and particularly so in Egypt. According to Bélon, it is the fæces of this animal which are collected for the druggists under the names of *cordylea*, *crocodilea* or *stercus lacerti*, which were formerly in vogue as a cosmetic; but it would rather appear that the antients attributed this name and quality to those of the Monitor. The Mahometans kill the present Stellio wherever they see it, because, as they say, it mocks them by bowing the head, as they do when at prayer.

DORYPHORUS, Cuv.

The pores wanting as in the Stellios, but the body is not bristled with small groups of spines*.

UROMASTIX †, Cuv.—STELLIONS BATARDS, Daud.

Mere Stellios, whose head is not enlarged, all the scales of their body being small, smooth, and uniform, and those of the tail still larger and more spiny than in the common Stellio; but there are none beneath. There is a series of pores under their thighs.

Stellio spinipes, Daud.; *Fouette-queue d'Egypte*, Geoff. Rept. d'Egyp. pl. II, f. 2. (The Common Uromastyx). Two or three feet long; the body inflated; altogether of a fine grass green; small spines on the thighs; the tail only spiny above. Found in the deserts which surround Egypt; it was formerly described by Bélon, who says, but without adducing proof, that it is the terrestrial Crocodile of the antients‡.

AGAMA §, Daud.

The Agamæ bear a great resemblance to the common Stellios, particularly in their inflated head; but the scales of their tail, which are im-

nate, or Fraud in the contract. It was probably the *Tarentole*, or the *Gecko tuberculeus* of the south of Europe, *Geckotte* of Lacep., as conjectured by various authors, and lately by M. Schneider. There is nothing to justify its application to the present species; Bélon, if I am not mistaken, was the first who abused it thus.

* *Stellio brevicaudatus*, Seb. II, lxxii, 6; Daud. IV, pl. 47. *St. azureus*, Daud., Id. 46.

† *Caudiverbera* and the Greek *ouromastix*, are not ancient names. They were coined by Ambrosinus for the great Egyptian species, of which Bélon had said "*cauda atrocissimè diverberare creditur.*" Linnæus was the first who applied it to a Gecko, and other authors have given it to different Saurians. Add, *Urom. griseus* of New Holland;—*Ur. reticulatus* of Bengal;—*Ur. acantinus*, Bell. Zool. Jour. I, 457, if it be a distinct species.

N. B. The flat-tailed Stellio of New Holland, Daud., is a *Phyllurus*.

‡ It is a *Uromastix* that is described by M. de Lacep. Rept. II, 497, under the name of *Quetzpaleo*, which is that of another Saurian, to be spoken of hereafter.—Add, *Ur. ornatus*, Ruppel.

§ *Agama*, from the Greek *agamos*, (bachelor). Why Linnæus gave this name to

bricate and not verticillate, distinguish them from that genus. Their maxillary teeth are nearly similar, and there are none in the palate. In the

COMMON AGAMÆ,

The scales are raised in points or tubercles; spines either singly or in groups bristle on various parts of the body, the vicinity of the ear especially. A row of them is sometimes seen on the neck, but without forming that palisado-like crest which characterizes the *Calotes*. The skin of the throat is lax, plaited transversely, and capable of being inflated.

In some species are found femoral pores. The

Ag. barbata, N., (The Ocellated Agama), is very remarkable for its size and extraordinary figure; a suite of large spiny scales extends along its back and tail in transverse bands, and approximate it to the *Stellios*. The throat, which can be greatly inflated, is covered with elongated and pointed scales, which make for it a sort of beard. Similar scales bristle on the flanks, and form two oblique crests behind the ears; yellowish spots edged with black under the belly. We must not confound with it the

Lac. muricata, Sh.; the *Muricated Agama* of the same country, Gen. Zool. Vol. III, part 1, pl. lxxv, f. 11; White, p. 244, in this the raised scales are disposed in longitudinal bands, between which are two series of spots paler than the ground, which is a blackish brown. It usually attains a large size.

Other species have no femoral pores.

Ag. colonorum, Daud.; Seb. I, cvii, 3*. (The Colonial Agama). Brownish, with a long tail; a small row of short spines on the neck; from Africa, and not, as is asserted, from Guiana.

There is a smaller Agama at the Cape, with a moderate tail, varied with brown and yellowish, bristled above with raised and pointed scales, the *Ag. aculeata*, Merr.†; Seb. I, viii, 6, lxxxiii,

one of these Lizards, it is impossible to conjecture; Daudin has extended it to the whole of the subgenus to which this species belongs, and thinks that *Agama* is the name given to it in the country of which it is a native.

A new species called *torquata* has lately been described by Messrs. Peale and Green, Jour. Acad. Nat. Sc. Philad. Vol. VI, p. 231, from Mexico, which they consider as approaching the *nigricollis*, Spix.—ENG. ED.

* Nothing can equal the confusion of the synonymes quoted by authors with respect to the different species of Lizards, and chiefly under divers *Agamæ*, *Calotes* and *Stellios*. The *Agama*, for instance, Daudin quotes from Gmelin, Seb. I, cvii, 1 and 2, which are *Stellios*; Sloane, Jam. II, cclxxiii, 2, which is an *Anolis*, Edw. cclxv, 2, which is also an *Anolis*; and the same fig. is again quoted by him and Gmel. for the *Polychrus*. Shaw even copies it to represent that same animal, with which it has nothing in common. Seb. I, cvii, 3, which is the true *Ag. colonorum*, Daud., is cited by Merrem as *Ag. superciliosa*; and Seb. I, cix, 6, which is his *aculeata*, is quoted as *orbicularis*, &c.

† The *Agama à pierreries*, Daud. IV, 410; Seb. I, viii, 6, is merely the young of this spiny Agama of the Cape, whose colours are more various than those of the adult. Add the *Ag. sombre* (*Ag. atra*), Daud. III, 349; rough, blackish; a yellowish line along the back;—the *Ag. ombre* (*Lac. umbra*) Daud., which is not the *Lac. umbra*, Lin., but distinguished from it by five lines of very small spines, which extend along the back, &c.

1 and 2, cix, 6; its belly sometimes assumes an inflated form, which leads to the

TAPAYES—AGAMES ORBICULAIRES, *Daud. in part*,

Which are mere Agamæ, with an inflated abdomen and a short and thin tail. Such is

Lac. orbicularis, L.; *Tapayaxin* of Mexico, Hern. 327. The back is spinous, and the belly sprinkled with blackish points*.

TRAPELUS, *Cuv.*

The Trapeli or Mutable Agamæ have the form and teeth of the Agamæ, but the scales are small and without spines; no pores on the thighs.

Trap. Ægyptius; *Le Changeant d'Égypte*, Geoff, Rep. d'Ég. pl. v, f. 3, 4. (The Mutable Agama). The adult, Daud. III, xlv, 1, under the name of *Orbicular*, is a little animal whose body is also sometimes inflated, and remarkable for changing its colours even more suddenly than the Chameleon. When young, it is entirely smooth; there are some scales a little larger scattered among the others on the body of the adult †.

LEIOLEPIS, *Cuv.*

Have the teeth of the Agamæ, the head less inflated, and are completely covered with very small, smooth, and compact scales. Pores on the thighs ‡. The

TROPIDOLEPIS, *Cuv.*

Are similar to the Agamæ in teeth and form, but regularly covered with imbricated and carinated scales. The series of pores are strongly marked §. The

LEPOSOMA, *Spix*.—TROPIDOSAURUS, *Boié*,

Only differ from Tropidolepis, by having no pores ||.

CALOTES**, *Cuv.*

The Calotes differ from the Agamæ in being regularly covered with scales, arranged like tiles, frequently carinated and terminating in a point

* I do not think the subgenus of the Tapayes can be preserved; the species of Hernandez (*Lac. orbicularis*, L.), Hern., p. 327, does not appear to differ from the *Agama cornuta* of Harlan, Phil. Ac. Nat. Sc. IV, pl. xlv, or, if at all, only from the sex. Daudin has put in its place, tom. III, pl. xlv, f. 1, the adult of the *Tap. ægyptius*.

† It is difficult to establish precise limits between this subgenus and certain short, thick Agamæ, that have but few spines.

‡ There is a species in Cochín China that is blue, with white stripes and spots, and a long tail (*Leil. guttatus*, Cuv.)

§ *Ag. undulata*, Daud., a species that is found throughout America, remarkable for a white cross under the throat, on a black-blue ground. The *Ag. nigricollaris*, Spix, XVI, 2, and *cyclurus*, XVIII, f. 1, are at least closely allied to it.

|| Spix has not expressed himself with precision in saying that the scales of his *leposoma* are verticillate, and this it is which has deceived M. Fitzinger. The genus *Tropidosaurus* was made by Boié from a small species from Cochín China, which is in the Cabinet du Roi.

** Pliny says that the *Stellio* of the Latins was called by the Greeks *Galeotes*,

on the body as well as the limbs and tail, which is very long; those on the middle of the back are more or less turned up, and compressed into spines, forming a crest of variable extent. They have no dewlaps or visible pores on the thighs, which, added to their teeth, distinguish them from the Iguanæ.

The most common species, *Lac. calotes*, L.; Seb. I, lxxxix, 2; xciii, 2; xcv, 3 and 4; Daud. III, xliii; *Agama ophiomachus*, Merr., is of a pretty light blue, with transverse white streaks on the sides; there are two rows of spines behind the ear. From the East Indies. It is called a Chameleon in the Moluccas, although it does not change its colours. Its eggs are fusiform*. The

LOPHYRUS, Duméril,

Have the scales of the body similar to those of the Agamæ; there is also a crest of palisado-like scales still higher than that of the Calotes. The tail is compressed, and the femoral pores are wanting. A remarkable species is,

Agama gigantea†, Kuhl.; Seb. I, c. 2, whose dorsal crest is placed very high on the neck, and is formed of several rows of vertical scales; two bony ridges, one on each side, extend from the muzzle to the eye, where they terminate in a point, and join on the temple. This singular Saurian appears to belong to India. The

GONOCEPHALUS, Kaup.,

Are closely allied to Lophyrus; their cranium also forms a sort of disk, by means of a ridge, which terminates in a notch above each eye. There is a dewlap and a crest on the neck. The tympanum is visible‡.

Colotes, and *Askalabotes*. It was, as we have seen, the *Geckotte* of Lacep. Its application, by Linnæus, to *Lac. calotes*, is arbitrary, and was suggested to him by Seba. Spix comprises our Calotes in his genus *LOPHYRUS*, which is not the same as that of Dumeril.

* Add, the *Ag. gutturosa*, Merr., or *cristatella*, Kuhl.; blue, without bands, and small scales on the back; Seb. I, lxxxix, 1;—the *Ag. cristata*, Merr., Seb. I, xciii, 4, and II, lxxvi, 5, a reddish brown, with blackish brown scattered spots, of which the *Agame arlequiné*, Daud. III, xlv, is the young;—the *Ag. vultuosa*, Harl. Phil. Ac. Nat. Sc. IV, xix (a). All these species are from the East Indies; the *Lophyrus ochrocollaris* and *margaritaceus*, Spix, XII, 2, are American Calotes; the first is the same as the *Agama picta*, Pr. Max.; the *Loph. panthera*, Spix, pl. xxiii, f. 1, is the young of the same. Add to these American Calotes, *Loph. rhombifer*, Spix, xi, of which the *Loph. abomaxillaris*, Id. XXIII, f. 2, is the young;—*Loph. auronitens*, Spix, pl. xiii. We might separate from the other Calotes a species from Cochin China, with a smooth back, without any visible scales; the belly, limbs, and tail covered with carinated scales (*Cal. lepidogaster*, Nob.); the *Ag. catenata*, Pr. Max. liv. V, may belong to this group.

N.B. The designer of Seba's plates has given to most of his Iguana, Agamæ, Calotes, &c., extensible and forked tongues, drawn from imagination.

† It is difficult to imagine the reason that induced Kuhl to call this Saurian gigantic, as it is not larger than its most closely allied Agamæ and Calotes.

‡ Isis, 1825, I, p. 590, pl. iii.

⌘ (a) Major Le Comte seems to have ascertained that the *Ag. vultuosa* is the young of another species.—ENG. ED.

LYRIOCEPHALUS, Merr.,

Unite with the characters of *Lophyrus*; a tympanum concealed under the skin and muscles, like that of the Chameleon: they also have a dorsal crest and a carinated tail.

In the species known, *Lyrio margaritaceus*, Merr.; *Lacerta scutata*, L.; Seb. cix, c, the bony crest of the eye-brows is still larger than in the *Ag. gigantea*, and terminates behind, on each side, in a sharp point. Large scales are scattered among the small ones on the body and limbs; imbricated and carinated scales on the tail; a soft, though scaly enlargement on the end of the muzzle. This truly singular species is found in Bengal and other parts of India*. It feeds on grain.

BRACHYLOPHUS, Cuv.

Have small scales; the tail somewhat compressed; a slightly salient crest on the neck and back; a small dewlap, a series of pores on each thigh, and, in a word, a strong resemblance to the Iguanæ; but they have no palatine teeth; those of the jaws are denticulate. Such is

L'Iguane à bandes, Brong., Essai et Mém. des Sav. Etr. I, pl. x, f. 5. (The Banded Iguana). From India. It is a deep blue, with light blue bands.

PHYSIGNATHUS, Cuv.

Have, with the same teeth, the same scales and pores; the head very much enlarged behind, and without the dewlap; a crest of large pointed scales on the back and tail, which is strongly compressed.

Ph. cocincinus, Nob., is a large species from Cochin China; blue, with stout scales, and some spines on the enlargements of the sides of the head. It lives on fruit, nuts, &c.

ISTIURUS, Cuv.—LOPHURA†, Gray.

The distinguishing character of this genus consists in an elevated and trenchant crest, which extends along a part of the tail, and which is supported by the high spinous apophyses of the vertebræ; this crest is scaly like the rest of the body; the scales on the belly and tail are small, and

* From this *Lyriocephalus*, the *PNEUSTES* of Merrem, and the *PHRYNOCEPHALUS* of Kaup, Fitzinger forms a family called *PNEUSTOIDEA*, which he approximates to that of the Chameleons. The *Pneustes* depend altogether on a vague and imperfect description of Azzara, II, 401, on which, also, Daudin had established his *Agame à queue prenante*, III, 440; Azzar. says that its ear is not visible, probably because it is very small. The *PHRYNOCEPHALUS* is composed of the *Lac. guttata* and the *Lac. uralensis*, Lepechin. Voy. I, p. 317, pl. xxii, f. 1 and 2, which form but one species. Kaup asserts that it has no external tympanum (Isis of 1825, I, 591). Not having seen these animals, I hesitate as to their classification. Another subgenus will probably have to be made of the *Lézard à oreilles*, (*Lac. aurita*, Pall.), Daud. III, xlv, remarkable for the faculty it possesses of inflating the two sides of the head under the ears: I have not, however, been able to examine it.

I have changed this name of *Lophura*, which is too much like that of *Lophyrus*.

approach somewhat to a square form; the teeth are strong, compressed, and without denticulations: there are none in the palate: there is a series of femoral pores. The skin of the throat is smooth and lax, but without forming a dewlap.

Lac. amboinensis, Gm.; the *Amboina Lophura*, *Le Porte-Crête*, Lacép.; Schlosser, Monog. cop. Bonnat. Erpet. pl. v, f. 2. The crest confined to the origin of the tail; some spines on the front of the back; lives in water, or on the shrubs about its shores; feeds on seeds and worms. We have discovered in its stomach both leaves and insects. It is sometimes found four feet in length. Its flesh is edible.

DRACO*, L.

The Dragons are distinguished at the first glance, from all other Saurians, by their first six false ribs, which, instead of encircling the abdomen, extend outwards in a straight line, and support a production of the skin, forming a kind of wing that may be compared to that of a Bat, but which is not connected with the four feet; it acts like a parachute in supporting them when they leap from one branch to another, but has not sufficient power to resist the air and raise them like a bird. Besides, the Dragons are small animals, completely invested with little imbricated scales, of which those on the tail and limbs are carinated. Their tongue is fleshy, and somewhat extensible. A long pointed dewlap hangs under their throat, supported by the tail of the os hyoides; there are also two smaller ones on the sides attached to the horns of the same bone. The tail is long; there are no porous granules on the thighs, and there is a little notch on the nape of the neck. Four small incisors are found in each jaw, and on each side a long and pointed canine, and twelve triangular and trilobate grinders.

They consequently have the scales and dewlap of the Iguanæ, with the head and teeth of the Stellio.

All the known species are from the East Indies; they were confounded for a great length of time, but Daudin has accurately determined their specific differences†.

SITANA‡, Cuv.

Teeth of the Agamæ, and four canini; body and limbs covered with imbricated and carinated scales; no pores on the thighs; but their ribs are not extended outwards. They are distinguished by an enormous dewlap which reaches to the middle of the belly, and which is twice the height of the animal.

Sit. ponticeriana, Cuv., is the only known species, and is from

* The term *drakon*, Gr., *draco*, Lat., generally designated a large Serpent; *Dragons*, with a crest or beard, are spoken of by antient writers, a description which can only apply to the *Iguana*; Lucian is the first who mentions *Flying Dragons*, alluding, no doubt, to the pretended Flying Serpents treated of by Herodotus; St. Augustine, and other subsequent authors, ever after described Dragons as having wings.

† The *Dragon rayé*;—the *Drag. vert.*, Daud. III, xli;—the *Drag. brun.*

‡ *Sitan* is the name of the species on the Coast of Coromandel.

the East Indies. It is small, fawn-coloured, and has a series of broad, brown, rhomboidal spots along the back.

It is perhaps to this tribe of the Agamæ that we should approximate a very extraordinary reptile, which is only to be found among the fossils of the old Jura limestone formation;

PTERODACTYLUS*, *Cuv.*

It had a short tail, an extremely long neck, and a very large head; the jaws armed with equal and pointed teeth; but its chief character consisted in the excessive elongation of the second toe of the fore-foot, which was more than double the length of the trunk, and most probably served to support some membrane which enabled the animal to fly, like that upheld by the ribs of the Dragon.

The second section of the Iguanian family, that of the IGUANIANS *proper*, is distinguished from the first by having teeth in the palate.

IGUANA, *Cuv.*

The Iguanas, or Guanas, properly so called, have the body and tail covered with small imbricated scales; along the entire length of the back, they have a range of spines, or rather of recurved, compressed, and pointed scales; beneath the throat a pendent, compressed dewlap, the edge of which is supported by a cartilaginous process of the hyoid bone; a series of porous tubercles on their thighs, as in the true Lizards; and their head covered with plates. Each jaw is surrounded with a row of compressed, triangular teeth, whose cutting edge is denticulate; there are also two small rows of the same on the posterior edge of the palate.

Ig. tuberculata, Laur.; *Lac. Iguana*, L.; Seb. I, xcv, 1, xcvi, 3, xcvi, 1. (The Common American Iguana†). Yellowish green above, marbled with pure green; the tail annulated with brown; preserved in spirits it appears blue, changing to green and violet, and dotted with black; paler beneath; a crest of large spiniform dorsal scales; a large round plate under the tympanum at the angle of the jaws; sides of the neck furnished with pyramidal scales scattered among the others; anterior edge of the dewlap denticulate like the back; from four to five feet in length: common in every part of South America, where its flesh is esteemed delicious, although unwholesome, particularly for those who have contracted syphilis, the sufferings peculiar to which it revives. It lives mostly on trees, occasionally visits the water, and feeds on fruit, grain, and leaves; the female lays in the sand eggs the size of those of a Pigeon, agreeable to the taste, and almost without white.

L'Iguane ardoisé, Daud.; Seb. I, xcv, 2, xcvi, 4. (The Slate-coloured Iguana). A uniform violet blue, paler beneath; the dorsal

* See my *Oss. Foss.* 2d ed. Vol. V, p. 2, pl. xxiii.

† The Mexicans call it *Aquaquetzpallia*, Hernand.; the Brazilians, *Senembi*, Marcgr.

spines smaller; in other respects similar to the preceding. Both of them have an oblique whitish line on the shoulder. The latter is from the same country as the former, and is probably a mere variety of age or sex*.

Ig. nudicollis, Cuv.; Mus. Besler. tab. XIII, f. 3; *Ig. delicatissima*, Laur. (The naked Iguana), resembles the common one, particularly in its dorsal crest, but has no infra-tympanal plate, nor the scattered tubercles on the sides of the neck. The upper part of the cranium is furnished with arched plates; the occiput is tuberculous; the dewlap is moderate, and has but few indentations, and those only in the anterior part. Laurenti says its habitat is India, but he is mistaken; we have received it from the Brazils, and from Guadeloupe†.

Ig. cornuta, Cuv.; *Ig. cornu de St. Dominique*, Lacep. Bonnat. Encycl. Method. Erpetolog. Lézards, pl. iv, f. 4. (The Horned Iguana). Very similar to the Common Iguana, and still more so to the preceding species, but is distinguished by a conical osseous point between the eyes, and by two scales raised up over the nostrils; the infra-tympanal plate is deficient as well as the tubercles on the neck, but the scales on the jaws are embossed.

Ig. cyclura, Cuv. (The Carolina Iguana). Destitute, like the two preceding species, of infra-tympanal plate or small spines on the neck, but carinated scales, rather larger than the rest, form cinctures on the tail at intervals‡.

OPHRYESSA, *Boié*,

Have small imbricated scales; a slightly salient dorsal crest, extending on the tail, which is compressed; denticulated maxillary teeth, and teeth in the palate: all these circumstances approximate them to the Iguana; but they have neither dewlap nor femoral pores.

Lac. superciliosa, L.; Seb. I, cix, 4; *Lophyrus xiphurus*, Spix, X, so called from a membranous carina, which forms its eye-brow, is an American species, of a fawn-colour, with a festooned brown band along each flank.

BASILISCUS, *Daud.*

The Basilisks have no pores, but have palatine teeth, like the Ophryessa; the body is covered with small scales; on the back and tail a continuous and elevated crest supported by the spinous apophyses of the vertebræ, like that on the tail of the Istiuri.

* I have every reason to think that this same conclusion should be extended to the Iguanas of Spix, pl. v, vi, vii, viii, and ix: they seem to me to be nothing more than various ages of the common species.

† I suspect the *Amblyrhynchus cristatus*, Bell. Zool. Journ. 1, Supp. p. xii, is a badly prepared specimen of my *Ig. nudicollis*.

‡ It also appears to me that this *Iguana* is the same which Dr. Harlan (Journ. Acad. Nat. Sc. of Phil. IV, pl. xv,) calls *Cyclura carinata*; but in this case there must be some mistake, as in the *Amblyrhynchus*, relative to the palatine teeth. These teeth exist in all my Iguanas.

The species known, *Lacerta basiliscus*, L.; Seb. I, c. 1; Daud. III, xlii, (Basilisk), is recognized by the hood-like membranous prominence of its occiput, that is supported by cartilage. It attains a large size, is bluish, with two white bands, one behind the eye, the other the back of the jaws, which are lost towards the shoulder*. It is from Guiana, and feeds on grain.

POLYCHRUS, Cuv.

The Marbled Lizards have the teeth in the palate as in the Iguana, and femoral pores, though the latter are not strongly marked; but the body is covered with small scales, and is destitute of a crest. The head is covered with plates; tail long and slender; throat very extensible, so that a dewlap is formed at the will of the animal, which, like the Chameleon, possesses the faculty of changing colour; the lungs, consequently, are very voluminous, occupy nearly the whole trunk, and are divided into several branches: the false ribs, like those of the chameleon, surround the abdomen by uniting so as to form perfect circles.

Lac. marmorata, L.; *Marbré de la Guiane*, Lacép. I, xxvi; Seb. II, lxxvi, 4; Spix, XIV. Reddish-grey, marbled with irregular transverse bands of a brown red, sometimes mixed with blue; the tail very long. Common in Guiana.†.

ECPHIMOTUS, Fitzinger.

The Marbled Lizards of Guiana have the teeth and pores of a Polychrus, but small scales on the body only; on the tail, which is very thick, they are large, pointed, and carinate; the head is covered with plates. Their form is somewhat short, and flattened, more like that of certain Agamæ than of a Polychrus.

The most common species, *Agama tuberculata*, Spix, XV, 1, or *Tropidurus torquatus*, Pr. Max.‡, is ash-coloured, sprinkled with whitish drops, and has a black semi-collar on each side of the neck. It inhabits Brazil.

OPLURUS, Cuv.

Teeth of a Polychrus, and the form of an Agama, but no pores on the thighs, and the pointed and carinated scales of the tail ally it to that of a Stellio; the dorsal scales also are pointed and carinate, but very small. One species only is known.

Opl. torquatus, Cuv. (The Black-collared Grey Quetzpaleo§). A black half-collar on each side of the neck. From Brazil.

* It is a mistake to believe, on the authority of Seba, that this species is the Basilisk of the Indies.

† Add, *Pol. acutirostris*, Spix, XIV.

‡ The *Tropidurus* of Pr. Max. de Wied. is not, as he imagined, the *Quetzpaleo* of Seba, although it is also marked with black semi-collars.

§ The name of *Quetzpaleo*, given by Seba to the above species, seems to be a corruption of the Mexican *Aqua quetz pallia*, which appears to be a name of the Iguana; the *Quetzpaleo* of Lacép., Rept. 4to. II, 497, is a *Uromastix*; but the figure quoted is that of Seba's animal.

ANOLIUS*, Cuv.

The Anolis, together with the whole of the forms of the Iguanas, particularly of the marbled genus, have a very peculiar distinguishing character: the skin of their toes is spread beneath the last phalanx but two into an oval disk, which is striated transversely on the under part; this disk assists them in adhering to various surfaces, to which they can also very effectually cling, by means of their very hooked nails. Further, they have the body and tail uniformly shagreened with small scales, and the greater proportion of them have a dewlap or goitre under the throat, which they can inflate and vary in colour when excited either by anger or desire. Several of them enjoy the faculty of changing the colour of their skin to an equal degree with the chameleon. Their ribs form entire circles like those of the *Polychrus* and *Cameleon*. Their teeth are trenchant and denticulate, as in *Polychrus* and *Iguana*, and they are even found in the palate. The skin of their tail is doubled into slight folds or depressions, each of which contains some circular rows of scales. This genus appears to be peculiar to America.

The tail of some is ornamented with a crest supported by the spinous apophyses of the vertebrae, as in *Istiurus* and *Basiliscus*†.

An. velifer, Cuv. (The Great-Crested Anolis). A foot long; a crest on the tail occupying half its length, supported by from twelve to fifteen rays; the dewlap extends under the belly. Its colour is a blackish ash-blue. From Jamaica and the other Antilles. We have found berries in its stomach.

Lac. bimaculatra, Sparrm. (The Little-Crested Anolis). Half the size of the preceding; the same crest; greenish, dotted with brown about the muzzle and on the flanks. From North America and several of the Antilles.

An. equestris, Merr. Fawn-colour, shaded with an ashy lilac; a white band on the shoulder; tail so fleshy that the apophyses of its crest cannot be perceived; a foot long.

Others again have a round tail, or one that is merely a little compressed. Their species are numerous, and have been partly confounded under the names of *Roquet*, *Goitreux*, *Rouge-gorge*, and *Anolis*,—*Lac. strumosa* and *bullaris*, L. They inhabit the hot parts of America and the Antilles, and change colour with astonishing facility, particularly in hot weather. When angry their dewlap becomes inflated and as red as a cherry. These animals are not so large as the Grey Lizard of Europe, and feed most commonly on in-

* *Anoli*, *Anoalli*, the name of these Saurians in the Antilles; *Gronovius*, very gratuitously, has applied it to the *Ameiva*. *Rochefort*, from whose work it was taken, only gives a copy of the *Teyuaguazu* of Marcgrave, or the Great Sauvegarde of Guiana. *Nicholson* seems to assert that this name is applied to several species, and the one he describes appears to be the *An. roquet*, which, in fact, was sent to the Museum from Martinique under the name of *Anolis*. M. M. de Jonnes has even ascertained that it is the only one by which it is now known.

† They have been confounded with each other, and with some of the following ones, under the names of *Lac. principalis* and *bimaculata*.

sects, which they actively pursue; it is said that whenever two of them meet, a furious combat inevitably ensues.


The species of the Antilles, or the *Roquet* of Lacep. I, pl. xxvii, which is more particularly the *Lac. bullaris*, Gm., has a short muzzle speckled with brown, and salient eye-lids; its usual colour is greenish. Its round tail excepted, it closely resembles the *Lac. bimaculata*. The *Anolis rayé*, Daud. IV, xlviii, 1, only differs from it in a series of black lines on the flank. It seems to be identical with the *Lac. strumosa*, L. Seb. II, xx, 4, and is somewhat longer than the preceding species.


The *Carolina Anolis*, *Iguane goitreux*, Brongn. Catesb. I, lxvi, is of a fine golden green; a black band on the temple and a long and flattened muzzle give it a peculiar physiognomy, and render it a very distinct species*.

It is to this family of the Iguanæ with palatine teeth, that belongs an enormous fossil reptile, known by the name of the *Maestricht Animal*, and for which the new name of *MOSASAURUS* has recently been coined†.

* Add the *Anolis à points blancs*, Daud. IV, xlviii, 2;—*An. viridis*, Pr. Max. lib. VI;—*An. gracilis*, Id., and several other species, of which, unfortunately, I have no figures to cite.

† See, upon this animal, my Oss. Foss. 5th vol. part 2. Amongst the fossiles, large reptiles have been discovered in a fossil state, which it appears should be approximated to this family, but their characters are not sufficiently known to enable us to class them with precision. Such are the *GEOSAURUS* discovered by Sømmering, the *MEGALOSAURUS* (a) of M. Buckland, the *IGUANODON* (b) of M. Mantell, &c. I have treated of them more at length in the volume referred to.

 (a) *Megalosaurus* is the name of a genus first established by Dr. Buckland, who found various bony remains of what he considers to be the animal of the large dimensions, described by him under that title. Teeth, vertebræ, a coracoid bone, ribs, and a supposed pelvis, described as belonging to an animal of this genus by Mr. Mantell, have been found in Tilgate Forest. The doubts which are entertained by Cuvier as to the correctness of the opinions expressed by Dr. Buckland and Mr. Mantell, concerning the existence of such an animal, are founded on the circumstance of these fragments having been found promiscuously intermingled with those of crocodiles and other oviparous reptiles. Cuvier is of opinion that this circumstance does not necessarily imply that the bones in question belong to animals of the same kind as those amongst which they had been found. The *Megalosaurus*, according to Dr. Buckland, was a gigantic Saurian reptile, entirely distinct from the crocodiles, but approximated very closely to the Monitors and Iguanas.

 (b) The *Iguanodon* is the name of a fossil animal, which has been described, in its complete state, by Mr. Mantell, from the evidences afforded by the materials of its osseous structure, which were found in the Tilgate Forest strata. Some of the teeth of this animal were first discovered in the year 1822, by Mrs. Mantell, a lady who forms, with two or three others of her sex, in this country, a small but highly distinguished group of laborious and successful female geologists, whose assistance in promoting science has become a subject of just pride to every Englishman. Subsequently, a series of these teeth was found, shewing every gradation of form, from the most perfect state of the tooth in the young animal, to the last stage in which it appears—a bony stump worn away by long employment in mastication. The structure of these teeth was so very remarkable, that Mr. Mantell was induced to send them to Paris, by the hands of Mr. Lyall, for the purpose of having them submitted to Cuvier's inspection. In the private communication made by that illustrious naturalist, after he had examined them, to Mr. Mantell, he acknowledged that he was altogether unacquainted with the teeth; that they could not have belonged to a carni-

FAMILY IV.

THE GECKOS.

This family is composed of nocturnal lizards, which are so similar that they may be left in one genus.

GECKO*, *Daud.*—ASCALOBOTES, *Cuv.*—STELLIO, *Schn.*

The Geckos are Saurians which do not possess the elongated graceful form of those of which we have hitherto spoken, but, on the contrary, are flattened, the head particularly, and have their feet moderate, and the toes almost equal; their gait is a heavy kind of crawling; their very large eyes, the pupil of which contracts at the approach of light, like that of a cat, render them nocturnal animals, which secrete themselves during the day in dark places. Their very short eyelids are completely withdrawn between the eye and the orbit, which gives them a different aspect from other Saurians. Their tongue is fleshy and non-extensible; their tym-

* *Gecko*, a name given to a species in India, in imitation of its cry, just as another one is termed *Tockaie* at Siam, and a third *Geitje*, at the Cape; *atkalagotes*, the Greek name of the Geckotte, Lacep.

vorous animal, but, from the small degree of complication about them, the dentations of their edges, and the thin laminæ of enamel which invested them, he concluded that they belonged to reptiles. From their external appearance, Cuvier would have taken them for the teeth of fishes, analogous to the Tetrodons, or Diodons; but the internal structure was altogether different. "Have we not in these teeth," writes Cuvier, "an herbivorous reptile; and, as now we find the species of largest dimensions amongst the herbivorous tribes of the land mammalia, may it not have been also the case, that, amongst the reptiles of former times, the largest were also sustained upon vegetable food? A portion of the large bones in your possession belongs to this animal, which is, up to the present time, the only species of its genus. Time alone will confirm or contradict this suggestion; for, it is not impossible, that a portion of the skeleton, joined to pieces of the jaws, may be found with teeth. If you could obtain only a very small portion of the jaw with adherent teeth, I think you would be able to resolve the problem." Mr. Mantell's account of the *Iguanodon* represents it to have been a horned animal of very large size. "The gigantic *Megalosaurus*, and yet more gigantic *Iguanodon*," observes Mr. Mantell, "to whom the groves of palms and arborescent ferns would be mere beds of reeds, must have been of such prodigious magnitude, that the existing animal creation presents us with no fit objects of comparison. Imagine an animal of the lizard tribe, three or four times as large as the largest crocodile; having jaws, with teeth equal in size to the incisors of the rhinoceros; and crested with horn: such a creature must have been the *Iguanodon*!"

The enormous size of the animal is thus given from a scientific calculation by Mr. Mantell:—

"Length of the animal, from the snout to the tip of the tail	70 feet.
head	4½ feet.
body	13 feet.
tail	52½ feet.
Height from the ground to the top of the head	9 feet.
Circumference of the body	14½ feet.
Length of the thigh and leg	8 ft. 2 in.
Circumference of the thigh	7½ feet.
Length of the hind foot, from the heel to the point of the long toe	6½ feet."

panum somewhat sunk; their jaws every where furnished with a range of very small closely-joined teeth; their palate without teeth; their skin, which is studded above with very small granular scales, among which are often found larger tubercles, has beneath scales somewhat smaller, which are flat and imbricated. Some species have the femoral pores. There are circular plaits on the tail as on that of an *Anolis*, but, when broken, it grows without these folds, and even without tubercles where these might be natural to them—circumstances which have led to an undue multiplication of species.

This genus is numerous and disseminated throughout the warm portions of both continents. The melancholy and heavy air of the Gecko, and a certain resemblance it bears to the Salamander and the Toad, have rendered it the object of hatred, and caused it to be considered as venomous, but of this there is no real proof.

The toes of most of them are widened along the whole or part of their length, and furnished beneath with regular plaits of skin, which enable them to adhere so closely, that they are sometimes seen crawling along ceilings. Their nails are variously retractile, and preserve their point and edge, which, conjointly with their eyes, authorize us to say, that the Gecko, as compared to other Saurians, is what the Cats are to the Carnivorous Mammalia; but these nails vary, according to the species, and in some are entirely wanting.

The first and most numerous division of the Geckos, which I will call the

PLATYDACTYLI.

The *Platydactyles* have the toes widened throughout their whole length, and covered beneath with transverse scales.

Some of these *Platydactyle* Geckos have no vestige of a nail, and their thumbs are very small. They are beautiful species, completely covered with tubercles, and painted with the most lively colours. Those known are from the Isle of France.

In some the femoral pores are deficient*.

One of them, *G. inunguis*, Cuv., is violet above, white beneath, with a black line on the flank. Another, *G. ocellatus*, Oppel., is grey, completely covered with ocellated brown spots with a white centre.

In some again these pores are very strongly marked†. Such is the *Gecko cepedien*, Peron, of the Isle of France; pale yellow, mottled with blue; a white line along each flank.

I am not sure, however, that the pores in this first subgenus are not indications of the sex of the animals.

Other *Platydactyli* have no nail to their thumb, or to the second and fifth toes of all the feet; the femoral pores are also deficient‡.

* M. Gray appropriates the name of *Platydactylus* to this division.

† It is from this division that M. Gray has made his genus *Phelsuma*; the *Lacerta gietje* of Sparrm. should belong to it. They are considered very venomous at the Cape.

‡ This division forms the genus *TARENTOLA* of Gray.

Such is,

Gecko fascicularis, Daud., *Lacert. facetanus*, Aldrov. 654, *Tarente* of Provence; *Tarentola*, or rather *Terrentola* of the Italians; *Stellio* of the ancient Latins; *Geckotte*, Lacep.; (The Wall Gecko); of a dark grey; rough head; the whole upper surface of the body studded with tubercles, each of which consists of three or four smaller ones; the scales on the under part of the tail similar to those on the belly. It is a hideous animal, which hides in holes of walls, heaps of stones, &c., covering its body with dust and filth. The same species appears to exist every where about the Mediterranean, and in Provence and Languedoc.

There is a neighbouring species in Egypt and in Barbary, with simple round tubercles, which are more salient on the flanks,—*G. ægyptiacus*, Nob. Egypt. Rept., pl. v, f. 7*.

The nails are only deficient in the four thumbs of the greater number of the platydactyle Geckos. They have a range of pores before the anus†. Such are,

Gecko, Lacep. I, xxix; *Stellio Gecko*, Schneid.; *Le Gecko à gouttelettes*, Daud.; Seb. cviii, the whole plate. Rounded, slightly salient tubercles over the upper surface of the body, whose red ground is sprinkled with round white spots; tail furnished beneath with square and imbricated scales. Seba says it is from Ceylon, and pretends that it is to this identical species that the name of *Gecko* is applied in imitation of its cry; but long before him it was attributed by Bontius to a species of Java. It is probable that the cry and the name are common to several species. We have ascertained that this one is found throughout the Archipelago of India.

Lac. vittata, Gm.; *Le Gecko à bandes*; *Lézard de Pandang*, at Amboine; Daud. IV, 1. Brown; a white band on the back, which bifurcates on the head and on the root of the tail; tail annulated with white. From the East Indies; found at Amboine on the branches of the shrub called the short Pandang‡.

There are some of these four-nailed Platydactyli whose body is edged with a horizontal membrane, and which have palmated feet. One of the most remarkable is

Lac. homalocephala, Crevelt., Soc. of Nat. of Berlin, 1809, pl. viii; the sides of whose head and body are augmented by a broad membrane, which is scalloped into festoons on the sides of the tail. Its feet are palmated. Found in Java and Bengal§.

There is another species in India with a bordered head and body, and palmated feet, but in which the festoons on the tail, and the pores near the anus, are deficient,—*PTEROPLEURA*, *Horsfieldii*, Gray, Zool. Jour. No. X, p. 222.

Finally, some Platydactyli have no nails to all their toes.

* This fig., intitled *Var. du Gecko annulaire*, has too many nails.

† This division is the *Gecko* proper of M. Gray.

‡ N. B. Daudin erroneously gives nails to the thumbs of these two Geckos.

§ This bordered Platydactylus forms the genus *Ptychozoon* of Fitzinger. M. Gray also separates his *PTEROPLEURA* from them on account of the absence of the pores.

There is a smooth species with palmated feet in France,—*A. Leachianus*, Cuv.

A second subdivision of the Geckos, which I call the

HEMIDACTYLI.

The Hemidactyles have the base of the toes furnished with an oval disk formed beneath by a double row of scales, en chevron: from the middle of this disk rises the second phalanx, which is slender, and has the third or the nail at its extremity. The species known have five nails, and a series of pores on each side of the anus. The sub-caudal scales form broad bands like those on the belly of serpents.

There is one species in the south of Europe, *G. verruculatus*, Cuv., of a reddish-grey; the back covered with little conical tubercles, somewhat rounded; circles of similar tubercles round the tail; found in Italy, Sicily, and Provence, like the *G. fascicularis*.

A very similar species, *G. mabuia*, Cuv., with still smaller tubercles, those of the tail more pointed; grey, clouded with brown; brown rings on the tail, abounds throughout the hot portions of America, where it enters the houses. It is known in the French colonies by the name of *Mabouia des murailles**.

There are others at Pondicherry and Bengal so very similar, that we are almost induced to believe that they have been carried there in vessels†.

A Hemidactylus with a bordered body, *G. marginatus*, Cuv., is also found in India; its feet are not palmated; the tail is horizontally flattened, and its edges are trenchant and somewhat fringed. It was sent from Bengal by M. Duvaucel.

The third division of the Geckos, which I shall call

THECADACTYLI.

The Thecadactyles have the toes widened throughout their length, and furnished beneath with transverse scales; but these scales are divided by a deep longitudinal furrow, in which the nail can be completely concealed.

In the species known to me the nails are deficient on the thumbs only; the femoral pores are wanting, and their tail is covered above and beneath with small scales.

G. lævis, D.; *Stellio perfoliatus*, Schn.; *Lac. rapicauda*, Gm.; *Le Gecko lisse*, Daud. IV, li, (The Smooth Gecko), known in the French colonies as the *Mabouia des bananiers*. Grey, marbled with brown; finely granulated, but without tubercles above; small scales beneath; its naturally long tail, which is encircled with plaits as usual,

* So far as we can judge from the figure, the *Thecadactylus pollicaris* and the *Gecko aculeatus*, Spix, XVIII, 2 and 3, seem to be different ages of this *Mabouia des murailles*. M. M. de Jonnès has given a monograph of them, but he confounds it with different species.

† To this division also belong the *G. à tubercules triédres* and the *G. à queue épineuse* of Daud.; the first is identical with the *Stell. mauritanicus* of Schn. The *Stell. platyurus*, Schn., is also closely allied to it.

is easily broken, and the new one that succeeds is sometimes considerably enlarged, resembling in its figure a small radish. It is from these accidental monstrosities that it has received the name of *G. rapicauda**.

The fourth division of the Geckos, or

PTYODACTYLI†.

Ptyodactyles have the ends of the toes only dilated into plates, the under surface of which is striated so as to resemble a fan. The middle of the plate is split, and the nail placed in the fissure. Each toe has a strongly hooked nail.

The toes of some are free, and their tail round.

Lac. gecko, Hasselq.; *Gecko lobatus*, Geoff. Rept. Egypt. III, 5; *Stellio Hasselquistii*, Schn. (The House Gecko); smooth; reddish-grey, dotted with brown; the scales and tubercles very small; common in houses on the south and east of the Mediterranean. At Cairo it is called *Abou burs* (the father of the leprosy), because they say that it does mischief by poisoning with its feet the food, but particularly the corned provisions, to which it is exceedingly partial. In passing over the skin it occasions a redness, but this is perhaps solely owing to the fineness of its nails. Its cry somewhat resembles that of a frog.

In others, each side of the tail is edged with a membrane, and the feet are semi-palmate; they are probably aquatic, and are the *UROPLATES* of Duméril.

Stellio fimbriatus, Schn.; *Le Gecko frangé*; *Tête plate*, Lac., or *Famo-Cantraca* of Madagascar, Brug.; Lacep. I, xxx; Daud. IV, lii. The membrane on the sides of the tail extending along the flanks, where it is slashed and fringed. Found in Madagascar upon trees, where it leaps from branch to branch. The natives, though without any reason, hold it in great fear‡.

Lac. caudiverbera, L.; *Gecko du Pérou*, Feuillee, I, 319. No fringe on the sides of the body, it being confined to those of the tail, on which there is also a vertical membranous crest. Feuillee found it in a spring in the Cordilleras. It is blackish, and more than a foot long.

We may make a fifth division,—the

SPHERIODACTYLI

Are certain small Geckos, the ends of whose toes terminate in a little pellet without folds, but always with retractile nails.

When this pellet is double or emarginated in front, they are closely

* The *G. squalidus*, Herm., if not the same as the *lævis*, belongs to this division. The *Gecko de Surinam*, Daud., is only a younger and better-coloured specimen of the *lævis*.

† From the Greek word *ptuon*, fan.

‡ According to Brugière's description, the *Sarroubé* of Madagascar has all the characters of the *Famo-cantraca*, except the fringe and a deficiency of the thumb in the fore feet. M. Fitzinger has taken it for his genus *SARRUBA*.

allied to the simple *Ptyodactyli*. The species known are from the Cape or from India: such is the

G. porphyre, Daud. Reddish-grey, marbled and dotted with brown*.

Most generally the pellet is simple and round. The species are all American: such is the

G. sputateur à bandes, Lacep. Rept. I, pl. xxviii, f. 1. A small species, prettily marked with transverse brown bands laid on a red ground: common in the houses of St. Domingo, where it is also called the *Mabouia*. There is a neighbouring species in the same island, but which is of a uniform ash-colour, Id. Ib. f. 2.

Finally, there are some Saurians which, possessing all the characters of Geckos, have no enlargement of the toes. Their five nails, however, are retractile.

Some of them have a round tail, and the toes striate beneath and indented along the sides, constituting the

STENODACTYLI.

There is one in Egypt, *Sten. guttatus*, Egyp. Rept. pl. V. f. 2 †. Smooth, grey, sprinkled with whitish spots.

Others have naked and slender toes: those which have a round tail form the

GYMNODACTYLI of Spix.

Some of these are found in America, with regular suites of small tubercles. The *Gymnodactylus geckoides*, Spix, X, viii, 1, also appears to be one of them.

Others again having their tail flattened horizontally, so as to resemble the shape of a leaf, I have given the name of

PHYLLURUS.

Only one species is yet known, and that is from New Holland, *Stellio phyllurus*, Schn.; *Lacerta platyura*, White, New South Wales, p. 246, f. 2 ‡. Grey, marbled with brown above; completely covered with small pointed tubercles.

We are compelled to establish a fifth Family,

FAMILY V.

CHAMÆLEONIANS,

For the single genus,

CHAMÆLEO §.

Or the Chameleons, which is very distinct from all other Saurian genera, and is not even easily introduced into their series.

* Daudin was mistaken in considering this Gecko as an American species, and synonymous with *mabouia*.

† Under the improper name of *Agame punctué*. It is reproduced in the Supp. pl. 1, f. 2; and a neighbouring species, f. 4.

‡ Referred, for some unknown reason, by Daudin to *Stellio*.

§ From *Chamaileon*, (Little Lion), the Grecian name of this animal. Aristotle, who uses it, has also given a perfect description of it. Hist. Ann. Lib. II, cap. xi.

Their skin is roughened by scaly granules, their body compressed, and the back—if we may so express it—trenchant; tail round and prehensile; five toes to each foot, but divided into two bundles, one containing two, the other three, each bundle being united by the skin down to the nails; the tongue fleshy, cylindrical, and extremely extensible; teeth trilobate; eyes large, but nearly covered by the skin, except a small hole opposite to the pupil, and possessing the faculty of moving independently of each other; no visible external ear, and the occiput pyramidically elevated. Their first ribs are joined to the sternum; the following ones are extended each to its fellow on the opposite side, so as to enclose the abdomen by an entire circle. Their lungs are so enormous, that when inflated, their body seems to be transparent, a circumstance which induced the ancients to believe that they fed on air. They live on insects, which they capture with the viscid extremity of their tongue; this is the only part of their body which has rapidity of motion, as in every thing else they are remarkable for their excessive slowness. The dimensions of their lungs probably is the source of the property of changing colour, which takes place, not, as is thought, in conformity with the hue of the bodies on which they rest, but according to their wants and passions. Their lungs, in fact, render them more or less transparent, compel the blood in a greater or less degree to return to the skin, and even colour that fluid more or less vividly in proportion to the quantity of air they contain. They always remain on trees.

Lac. africana, Gm.; *Caméléon ordinaire*, Lacep. I, xxii; Seb. I, lxxxii, 1, lxxxiii, 4*. (The Common Chameleon). The hood pointed and relieved by a ridge in front; the granules on the skin equal and close; the superior crest indented as far as half the length of the back, the inferior to the anus. The hood of the female does not project so much, and the denticulations of her crests are smaller. From Egypt, Barbary, and even the south of Spain, and India.

Cham. tigris, Cuv. (The Tiger Chameleon). Another similar species from the Sechelle Islands, with a hood resembling that on the female of the preceding; the granules on the skin minute and equal; it is distinguished by a denticulated and compressed appendage under the extremity of its lower jaw. The body is sprinkled with black points.

Cham. verrucosus, Cuv. (The Warty Chameleon). A third neighbouring species from the island of Bourbon, marked by granules larger than the others which are scattered among them, and by a series of warts, parallel to the back at about two-thirds of its height. The hood is like that on the female of the common one; the notches on the back are deeper, those on the belly more shallow.

Cham. pumilus, Daud. IV, liii; *Lacerta pumila*, Gm.; *Cham. margaritaceus*, Merr.; Seb. lxxxii, 4, 5. (The Dwarf Chameleon). The hood directed backwards; warts scattered on the flanks, limbs

* The *Cam. trapu*, Egyp. Rept. IV, 3; *Ch. carinatus*, Merr.; *Ch. subcroceus*, Id.?

and tail; numerous, compressed, finely notched appendages (lambeaux) under the throat, which vary in each individual. Found at the Cape, Isle of France, and the Sechelles*.

Ch. planiceps, Merr. Seb. I, lxxxiii, 2; *Lacerta chamælion*, Gm. (The Chameleon of Senegal). The hood flattened, and almost destitute of a ridge; its figure is a horizontal parabola. Found in Senegal, Barbary, and even in Georgia.

Ch. pardalis, Cuv. The hood flat like that of the Senegal species; but there is a little prominent edge to its muzzle, in front of the mouth; larger granules scattered among the smaller ones, and the body irregularly marked with round black spots, edged with white. From the Isle of France.

Ch. Parsonii, Cuv. Phil. Trans. LVIII. Another species, with a flat hood, which is slightly truncated behind; crest of the eyebrow prolonged and turned up, on each side of the end of the muzzle, into an almost vertical lobe. The granules are equal, and there is no emargination either above or beneath†. Finally, the

Ch. bifurcus, Brongn.; *Caméleon des Moluques à nez fourchu*, Daud. IV, liv, has a semicircular flat hood; two large compressed, salient prominences in front of the muzzle, which varies in length; probably a sexual difference. The granules are equal, the body is sprinkled with closely set blue spots, and at the bottom of each flank is a double series of white ones.

The Sixth and last Family of the Saurians is,

FAMILY VI.

SCINCOIDEA.

Known by their short feet, non-extensible tongue, and the equal scales which cover the body and tail, like tiles.

SCINCUS, Daud.

The Scincs have four short feet; the body and tail almost one continued and uniform piece; no enlargement of the occiput; without crest or dewlap, and covered with uniform, shining scales, arranged like tiles, or those of a Carp. Some of them are fusiform; others, more or less elongated, resemble Serpents, the *Anguis* particularly, to which they are related by several internal affinities, and which they connect with the family of the Iguanida, by an uninterrupted series of transitions. Their tongue is fleshy, but slightly extensible and emarginate; the jaws every where furnished with small, closely set teeth. In the anus, eye, ear, &c., they bear a greater or less resemblance to the Iguanæ and Lizards; the feet are furnished with free and unguiculated toes.

* I believe the *Cham. seichellensis* of Kuhl to be a female of the *pumilus*.

† I do not know the *Cham. dilepis*, Leach, or *bilobus*, Kuhl.

Certain species have palatine teeth, and an emargination on the anterior edge of the tympanum.

Among this number, on account of its trenchant and somewhat raised muzzle*, we should distinguish the

Scinc. officinalis, Schn.; *Lac. scincus*, Lin.; *El Adda* of the Arabs; *Le scinque des pharmacies*, Lacep. I, xxiii; Bruce, Abyss. pl. 39; Egypt. Rep. Suppl. pl. 2, f. 8. (The Official Scinc). Six or eight inches long; the tail shorter than the body; the latter of a silvery yellow; transverse blackish bands; inhabits Nubia, Abyssinia, and Arabia, whence it is sent to Alexandria, and from thence distributed throughout Europe. It possesses a surprising facility of burying itself in the sand when pursued†. Among those which have blunt muzzles we may observe a species diffused throughout India; the *Sc. rufescens*, which is greenish, with a yellowish line along the flanks; each scale has three small raised ridges. There is one from the south of Africa, very common in the vicinity of the Cape—the *Sc. trivittatus*; brown; three paler lines along the back and tail; black spots between the lines‡.

We should especially notice the great Levant species, *Sc. cyprius*, Cuv., *Lac. cyprius sincoides*, Aldrov. Quadr. Dig. 666; Geoff. Desc. de l'Egypt, Rept. pl. iii, f. 3, under the name of *Anolis gigantesque*, which is greenish, with smooth scales; the tail longer than the body, and a pale line along each flank.

In other Scincs, the TILIQUA of Gray, the palatine teeth are wanting.

There is one of these very common in the south of Europe, Sardinia, Sicily, and Egypt; *Sc. variegatus*, *Sc. ocellatus*, Schn.; Daud. IV, lvi; Geoff. Eg. Rept. pl. v, f. 1, under the name of *Anolis marbré*; and better, Savigny, Ib., Supp. pl. ii, f. 7, which has small, round black spots, each marked with a white streak on the back, flanks, and tail. There is most commonly a pale line along each side of the back.

* This species alone composes the genus SCINCUS of Fitzinger, the others constitute his genus MABOUIA.

† The Greeks and Latins called the *Terrestrial Crocodile*, Seineus; it was consequently a Monitor to which they attributed so many virtues; but since the middle ages, the above species is usually sold under this name, and for the same purposes. Eastern nations, in particular, consider it as a powerful aphrodisiac.

‡ Add, *Sc. erythrocephalus*, Gilliams, Ac. Nat. Sc. Phil. I, xviii, (or the *Scorpion Lizard*, Penn.);—*Sc. bicolor*, Harlan, Ib. IV, xviii, 1;—*Sc. multiseriatus*, Nob.; Geoff. Eg. Rep. IV, f. 4, under the name of *Anolis pavé*.—We also think it proper to refer to this subdivision, although we have not been able to procure the animal, the great Seineus, called in Jamaica the *Galley Wasp*; Sloane, II, pl. 273, f. 9, (*Lac. occidua*, Sh.) (a).

§ (a) Messrs. Peale and Green in the 6th vol. of the "Journal of the Academy of Natural Sciences in Philadelphia," describe a new species, which they call *S. ventralis*. It is fifteen inches long, with a long tail, the body being above olivaceous with some black spots, and white beneath; scales on the back carinated and imbricate; folds spotted on each side of the body. These gentlemen propose to make this species the foundation of a genus to be called PTEROGASTERUS. It is a native of Mexico, where it is known as an extremely venomous creature under the name of *Escorpion*.—ENG. ED.

The French Antilles produce several species, one of which is improperly called there the *Anolis de terre*, and *Mabouia*; Lacep. pl. xxiv; it is smooth; of a greenish brown, and has blackish points scattered along the back; a brown band imperfectly terminated, reaching from the temple over the shoulder, and beyond it*.

The Moluccas and New Holland produce some species of this division, which are remarkable for their thickness†.

SEPS‡, Daud.

The Seps only differ from the Scincs in their more elongated body, which is exactly similar to that of an Anguis, and in the still smaller feet, the two pairs of which are further apart. Their lungs begin to exhibit some inequality.

There is one species, *S. scincoides*, Cuv., with five toes, of which the posterior are unequal.

One with five nearly equal and short toes, *Anguis quadrupes*, L.; *Lacerta serpens*, Gm.; Bloch, Soc. of Nat. of Berl. vol. II, pl. 2§. From the East Indies.

One with four toes, the posterior of which are unequal; (*Tetradactylus decresiensis*, Per.||; and one with three, very similar otherwise to the preceding, the *Tridactylus decresiensis*, Per. Both are from the island of Cres, and are viviparous.

A fifth, with three short toes, and very small feet, called in Italy, *Cecella* or *Cicigna*,—*Lac. chalcides*, L., is grey, with four longitudinal brown stripes, two on each side of the back. It is viviparous also, and moves with rapidity without the aid of its feet; lives in meadows, and feeds on spiders, small snails, &c.**

The southern provinces of France produce a sixth, very similar to the preceding, but with eight or nine brown stripes placed at equal distances apart,—*Zygnis striata*, Fitz.

We might separate from the rest a species whose carinated and

* The fig. of Lacep. is exact, the tail excepted, which is too short, it having been broken in the original, an accident which frequently occurs to all Lizards.—Add the *Sc. à flancs noirs*, Quoy and Gaym. Voy. de Freye., pl. 42;—*Sc. bistriatus*, Spix, XXVI, 1.

† *Lac. scincoides*, White, 242;—*Sc. nigroluteus*, Quoy et Gaym. Freyc. 41;—*Sc. crotaphomelas*, Per. and Lacep., &c. N.B. I have given but few species of Scineus, because they are so badly characterized by authors, that it is almost impossible to indicate their synonyms with any certainty. There is no genus which stands more in need of a monograph than this.

‡ *Seps* and *Chalcis* were the antient names of an animal which some consider as a Lizard, and others a Serpent. It is very probable that they designated the three-toed Seps of Greece and Italy. Seps is derived from the Greek *sepein*, (to corrupt).

§ It forms the genus *LYGOSOMA* of Gray; Fitzinger leaves it among his *MABUIA*, or Scincs without palatine teeth.

|| It is to this species that Fitzinger appropriates the generic name of SEPS—he calls it *Seps Peronii*.

** Merrem, on the contrary, had made his genus SEPS from this single species. Fitzinger now calls it *ZYGNIS*, in imitation of Oken, and adds to it the *Tridactylus decresiensis*, from the island of Cres, of Per., which is much more nearly allied to the *Tetradactylus* of the same island.

pointed scales are nearly verticillate*; *Lac. anguina*, L.; *Lac. monodactyla*, Lacep. Ann. Mus. II, lix, 2, and Vosmaer, Monog. 1774, f. 1, under the name of *Serpent-Lizard*. Its feet are merely small undivided spurs. Inhabits the environs of the Cape of Good Hope.

BIPES, Lacep.

The Bipeds are a small genus, only differing from Seps in the entire absence of fore feet, having the scapulæ and clavicles concealed beneath the skin, the hind feet alone being visible. There is only a step from it to *Anguis*.

Some of them have a series of pores before the anus†.

I dissected one of them brought from New Holland by the late M. Péron, the *Bipède lepidopode*, Lacep. Ann. du Mus. tom. IV, pl. lv, which has carinated scales on the back, and a tail twice the length of the body‡. Of its feet, nothing is externally visible but two small oblong and scaly plates; but by dissection we find a femur, a tibia, a fibula, and four metatarsal bones forming toes, but without phalanges. One of its lungs is half the size of the other. It lives in the mud.

This series of pores is wanting in others.

A small species, described a long time ago, is found at the Cape, *Anguis bipes*, L.; *Lacerta bipes*, Gm.; Seb. I, lxxxvi, 3, each of whose feet is terminated by two unequal toes§.

Brazil produces another, *Pygopus cariococca*, Spix, xxviii, 2; larger, with undivided feet like those of the *lepidopode*, Lacep., but more pointed, and with entirely smooth scales. It is greenish, with four longitudinal blackish lines||.

CHALCIDES, Daud.

The Chalcides are elongated Lizards, like Seps, resembling Serpents; but the scales, instead of being arranged like tiles, are rectangular, forming transverse bands, which do not encroach on each other like those on the tails of ordinary lizards.

Some of them have a furrow on each side of the trunk, and a still very apparent tympanum. They are allied to *Cordylus* just as Seps is connected with *Scincus*, and lead in many points to *Pseudopus* and *Ophisaurus*.

A five-toed species is known, *Lac. seps*, L., which inhabits the

* It is the genus *MONODACTYLUS*, Merr., or *CHAMESAURA*, Fitz.

† They form the genus *PYGOPUS* of Merrem.

‡ The fig. of Lacep. is drawn from an individual, the tail of which had been broken off and reproduced; we are very liable, generally speaking, to be mistaken in the proportionate length of the tail in all this class.

§ It is the genus *BIPES*, Merr., or *SCELOTES*, Fitz. The *Seps gronovien*, or *monodactyle* of Daudin, of which Merrem has made his genus *PYGODACTYLUS*, was merely a badly preserved specimen of the same, so that this genus must be stricken out, as Merrem suspected would be the case. The *Seps sexlineata*, Harl., &c. Nat. Sc. Phil. IV, pl. xviii, f. 2, is a mere variety of it.

|| The *Pyg. striatus*, Spix, XXVIII, 1, appears to me to be the young of the same species.

East Indies. Another with four toes, *Lac. tetradactyla*, Lacep. Ann. du Mus. II, lix, 2*. In others the tympanum is concealed, leading directly to Chirotæ, and thence to the Amphibænæ. There is one species with five toes†; and a second in Brazil with four anterior and five posterior, the *Hetrodactylus imbricatus*, Spix, xxvii, 1; a third with four to each foot‡; a fifth, whose toes, to the number of five before and three behind, are reduced to such small tubercles, that it has at one time been considered as having three, and at another but one§. From Guiana.

CHIROTES, Cuv.

The Bimana resemble the Chalcides in their verticillate scales, and still more so the Amphibænæ in the obtuse form of their head; but are distinguished from the first by the absence of hind feet, and from the second by the presence of the anterior feet. One species only is known.

Chamæsaura propus, Schn.; *Lac. lumbricoïdes*, Shaw; *Bipède cannelé*, Lacep. I, xli, has two short feet, each having four toes, with a rudiment of a fifth, completely organized interiorly, attached by scapulæ, clavicles, and a small sternum; but the head, vertebræ, and in fact the whole remainder of the skeleton, resembling that of the Amphibænæ. It is from eight to ten inches long, and about the thickness of the little finger; flesh coloured; the back invested by about two hundred and twenty half rings; there are as many on the belly, which meet alternately on the side. It is found in Mexico, where it feeds on insects. Its slightly extensible tongue terminates in two small horny points; eye very small; tympanum covered by the skin, and invisible externally; two series of pores before the anus. I found in them but one large lung, and a vestige of a smaller one as in most, Serpents||.

* It is the genus TETRADACTYLUS of Merr., or SAUROPHIS of Fitzinger.

† This species forms the genus CHALCIDES of Fitzinger.

‡ The genus BRACHYPUS, Fitz.

§ In the first case it is the *Chalcide*, Lacep., pl. xxxii*; the *Chamæsaura cophias*, Schn., the genus CHALCIS, Merr., and the genus COPHIAS, Fitz.; in the second it is the *Chalcide monodactyle*, Daud., or the genus COLOBUS, Merr.; but all these genera are reducible to one single species.

|| The genera which terminate this order of Saurians interpose themselves in so many various ways between the ordinary Saurians and the genera placed at the head of the Ophidians, that several naturalists now think it improper to separate the two orders; or they establish a single genus, comprising, on the one hand, the Saurians, with the exception of the Crocodiles,—and the Ophidians of the Anguis family on the other. But among the fossils of the antient calcareous formations, we find two much more extraordinary genera, which, to the head and trunk of a Saurian, add feet attached to short limbs, and formed of a multitude of little articulations collected into a species of oar or fin, similar to the fins or fore feet of the Cetacea.

One of these genera, ICHTHYOSAURUS (a), had a thick head attached to a short neck, enormous eyes, moderate tail, an elongated muzzle armed with conical teeth fastened in a groove. Different species, some of them very large, have been discovered in England, France, and Germany.

The other, PLESIOSAURUS (a), had a small head attached to a long serpentlike

(a) Mr. Mantell informs us, that vertebræ, teeth, and other bones of the Plesiosaurs have been found in the strata of Tilgate Forest. To Mr. Conybeare

ORDER III.

OPHIDIA*.—SERPENTS.

THE Serpents are Reptiles without feet, and consequently those among them all which most deserve the title of Reptiles. Their extremely elongated body moves by means of the folds it forms when in contact with the ground. They are divided into three families.

FAMILY I.

ANGUINA†.

The Angues still have an osseous head, teeth, and tongue, similar to those of a Seps; their eye is furnished with three lids, &c., and, in fact,

neck, composed of a greater number of cervical vertebræ than is found in any other animal known; its tail was short; some of its remains have also been found on the continent.

These two genera, for the possession of which we are chiefly indebted to the exertions of M. Home, Conybeare, Buckland, &c., inhabited the sea. They form a very distinct family, but what is known of their osteology approximates them much more closely to the common Saurians than to the Crocodiles, with which Fitzinger has associated them in his family of the LORICATA; and so much the more gratuitously, as neither their scales nor their tongue, the two characteristic parts of the Loricata, are known.

* From the Greek word *ophis*, (a serpent).

† *Anguis*, the Latin generic term for Serpents.

and the other gentlemen whose names are mentioned above, we are indebted for the descriptions of the two genera of fossil animals alluded to in the note—the *Plesiosaurus* and *Ichthyosaurus*. They are supposed to have been oviparous, and to belong to the family of the Saurians, but differing very essentially from all existing species, and in such particulars as evidently must have fitted them to live entirely in the sea. Their vertebræ are deeply cupped like those of fishes, and are as thin as those of the shark, so as to admit of a vibratory motion of the tail, to assist progression. The extremities terminate in four paddles, composed of a series of flat polygonal bones, greatly exceeding in number even the phalangeal cartilages of the fins of fishes. The most wonderful animal of this division is the *Plesiosaurus dolichodeirus*, or long-necked *Plesiosaurus*; the neck of this animal is equal to half the entire length of the body and tail united, and is composed of thirty-five vertebræ; the back of twenty-seven, and the tail of twenty-eight; making a total of ninety. The head is so small, that its length is not more than a fifth part of that of the neck.

In the summer of 1832, Mr. Mantell made a discovery in a quarry of the Tilgate grit of fragments of bones, which he has used as the foundation of a new Saurian genus, called by him *Hylæosaurus*, from the Greek words, *ule*, (wood, weald, or forest), and *Saurus*, (Lizard). He calls it also the Wealden Lizard, or Fossil Lizard of Tilgate, and gives an elaborate and highly interesting description of its anatomical details, in his beautiful work "The Geology of the South-East of England." In this work he notices also another new herbivorous reptile, discovered by Dr. Jäger of Stuttgart, in what is called the Keuper formation of Germany, near Wirtemberg.—
ENG. ED.

if we may so express it, they are Seps without feet; they are all comprised in the genus

ANGUIS, *Lin.*

The Blind Worms, which are characterized externally by imbricated scales, with which they are completely enveloped. They have been separated into four subgenera; in the three first we still find beneath the skin the bones of the shoulder and pelvis.

PSEUDOPUS, *Merr.*

Have the tympanum visible externally, and on each side of the anus a small prominence* which contains a little bone analogous to the femur, connected with a true pelvis concealed under the skin. As to the anterior extremity it hardly shows itself externally, its only mark being a fold not easily detected; it has no internal humerus. One of its lungs is a fourth less than the other. The scales are square, thick, and semi-imbricate, some of which, between those on the back and those on the belly, being smaller, occasion a longitudinal furrow on each side.

Pallas has described a species of the south of Russia, which is also found in Hungary, and in Dalmatia; the *P. Pallasii*, Nob.; *Lacerta apoda*, Pall. Nov. Com. Petrop. XIX, pl. ix, f. 1; from twelve inches to two feet in length; scales on the back smooth; those on the tail carinated.

M. Durville has discovered another in the Archipelago, *Ps. Durvillii*, Cuv., whose dorsal scales are rough and carinate like those on the tail. The

OPHISAURUS†, *Daud.*

The Lizard Serpents only differ from the preceding subgenus in the entire deficiency of any external appearance of posterior extremities; the tympanum, however, is still visible, and the scales also form a fold on each side of the body. The small lung is one-third as large as the other.

The most antiently known species, *Oph. ventralis*; *Ang. ventralis*, L., Catesb. II, lix, is common in the United States. It is of a yellowish-green, spotted with black above; the tail is longer than the body, and is so easily broken, that it is commonly termed the Glass-Snake‡.

ANGUIS, *Cuv.*

The Blind Worms, properly so called, have no external appearance whatever of an extremity; the tympanum even being concealed under the skin; the maxillary teeth compressed and hooked, and none in the palate. The body is surrounded with imbricated scales, but has no fold on the side. One of the lungs half the size of the other.

* *Pseudopus*, i. e. false foot. I have never been able to discover any division of the extremity of this very small vestige of a foot. M. Schneider has been equally unsuccessful.

† From the Greek words, *ophis*, a Serpent, and *sauros*, a Lizard.

‡ Add *Ophis punctatus*; *Oph. striatulus*, Nob.; two new species.

One species is very common throughout Europe; *Anguis fragilis*, L., Lacep. II, xix, 1, which has very smooth, shining scales, silvery yellow above and blackish beneath; three black lines along the back, which change by age into various series of points, and finally disappear. Its tail is as long as the body, the whole animal being a foot and some inches; it feeds on lumbrici and insects, and produces its young alive*.

These three genera still have an imperfect pelvis, a small sternum, a scapula, and clavicle, hidden under the skin. The absence of all these bony parts compels us to separate the subgenus I call

ACONTIAS†, Cuv.

Which still resemble the preceding in the structure of the head, and in the eye-lids, but in which there is neither sternum nor vestige of a shoulder or pelvis. The anterior ribs unite with each other beneath the trunk, by cartilaginous prolongations. I have only found one moderate sized lung, and another that is very small. The teeth are small and conical, and I think I have perceived them in the palate. These animals are easily recognized by their muzzle, which is enclosed as in a sort of mask.

The well-known species, *Anguis meleagris*, L., Seb. II, xxi, 1‡, inhabits the Cape of Good Hope. It resembles the *A. fragilis*, but its obtuse tail is much shorter; eight longitudinal rows of brown spots decorate its back. The same country produces other species, one of which is completely blind, the *Ac. cæcus*, Cuv.

FAMILY II.

SERPENTIA.

THE true Serpents, which are by far the most numerous, comprise the genera without either sternum or the vestige of a shoulder, but the ribs still surround a great part of the circumference of the trunk, and in which the body of each vertebra is still articulated by a convex surface to a cavity in the succeeding one; the third eye-lid and the tympanum are

* The *Anguis erix*, L., is merely a young specimen of the *fragilis*, in which the dorsal lines are still well marked; the *A. clivicus*, of which Daudin makes an *Erix*, no one knows why, is an old animal of the same species, with a truncated tail. It is only quoted from Gronovius, who cites the Coluber of Gesner. This Coluber is an old *fragilis*.

† *Acontias* (*javelin*) the Greek name of a Serpent, which was believed to dart upon the passenger, from *Akontizo*, *jacular*.

‡ Daudin has also made an *Erix* of the *Anguis meleagris*, but without any reason, for its inferior scales are not larger than the others. I have ascertained, by dissection, that this Serpent has no sternum, so that the supposition of M. Oppel to the contrary is erroneous.

deficient; but the malleus of the ear exists under the skin, and its handle passes behind the tympanum. There is still a vestige of a posterior limb, concealed under the skin, in several of this family, and which in some of them shows its extremity externally in the form of a small hook*.

We subdivide them into two tribes.

That of the *AMPHISBÆNÆ* (the Double Walkers), as in the preceding reptiles, still has the lower jaw supported by a tympanal bone directly articulated with the cranium, the two branches of this jaw soldered together in front, and those of the upper one fixed to the cranium and to the intermaxillary bone,—circumstances that prevent that dilation of the mouth which obtains in the succeeding tribe, and which occasions a uniformity of the head and body, a form which enables them to move backwards or forwards with equal facility. The bony frame of the orbit is incomplete behind, and the eye very small; the body is covered with scales, the anus is close to its extremity, the trachea long, and the heart very far back. They are not venomous.

They form two genera, one of which is allied to *Chalcides* and *Chirotes*, and the other to *Anguis* and *Acontias*.

AMPHISBÆNA†, L.

The whole body surrounded with circular ranges of quadrangular scales, like the *Chalcides* and the *Chirotes* among the *Saurians*; a series of pores before the anus, a few conical teeth in the jaws, but none in the palate. There is but one lung.

Two species have long been known, *Amph. alba*, Lacep. II, xxi, 1; and *Amph. fuliginosa*, L., Seb. II, xviii, 2, C. 3, and lxxiii, 4, both from South America. They feed on insects, and are often found in ant-hills, which has occasioned a belief among the people that the large ants are their purveyors. They are oviparous‡.

There is another in Martinique entirely blind, *Amph. cæca*, Cuv.||

The *LEPOSTERNON*, Spix, are *Amphisbænæ*, the anterior part of whose trunk has a collection of plates above which interrupts the rings. They have no anal pores, their head is short, and their muzzle is somewhat elongated§.

* See the dissertation (German) of M. Mayer on the posterior extremities of the Ophidians, in the 12th vol. des *Curieux de la Nature* of Bonn.

† From the Greek words *amphis* and *bainein*, walking both ways. The ancients attributed two heads to it. This name has been erroneously applied to some American Serpents, which it is impossible the ancients could have known.

‡ The *Amph. flavescens*, Pr. Max. lib. ix.

|| May it not be the *A. vermicularis*, Spix, XXV, 2? he says, "*oculi vix conspicui*"—I can see none. He employed the same expression for his *A. oxyura*.

§ *Lep. microcephalus*, Spix, or *Amph. punctata*, Pr. Max.

TYPHLOPS*, *Schn.*,

Have the body covered with small imbricated scales like *Anguis*, with which they were long classed; the projecting muzzle furnished with plates†; tongue long and forked; the eye resembling a point hardly visible through the skin; the anus close to the very extremity of the body; one of the lungs four times larger than the other. They are small Serpents, at the first glance resembling earth-worms; they are found in the hot portions of both continents.

In some of them the head and body are of one uniform appearance, the former obtuse. They resemble pieces of slender twine‡.

Most of them have a depressed and obtuse muzzle, furnished before with several plates§.

The front of the muzzle in some is covered with a single large plate, the anterior edge of which is somewhat trenchant||.

Finally, there is another whose muzzle is terminated by a little conical point, and which is entirely blind. Its posterior extremity is enveloped with an oval and horny shield¶.

In the second tribe, that of the SERPENTES, or SERPENTS, properly so called, the tympanal bone or pedicle of the lower jaw is moveable, and is itself always suspended to another bone, which is analogous to the mastoid process, attached to the cranium by muscles and ligaments, which allow it some motion. The branches of this jaw are not so closely united with each other, and those of the upper one are merely connected with the intermaxillary bone by ligaments, so that they can separate to a greater or less extent, which enables these animals so to dilate their mouths as to swallow bodies larger than themselves.

Their palatine arches participate in this facility of motion, and are armed with sharp pointed teeth, which curve backwards, the most predominant and constant character of the tribe. Their trachea is very long, their heart very far back, and most of them have but one large lung with a vestige of another.

These Serpents are divided into venomous and non-venomous; and the

* From the Greek word *Tuphlops*, or *Tuphline*, blind, the names of the *Anguis* (slow-worms) among the Greeks. Spix has substituted *STENOSTOMA*.

† I could find no teeth in those I examined.

‡ *T. braminus*, Cuv., or *Rondos-talaloopam*, Russel, Serp. Corom. XLIII, or *Eryx braminus*, Daud., or *Tortrix Russelii*, Merr.

§ *Ang. reticulatus*, Sch., Phys. Sacr. pl. dccxlvii, 4;—*Typhlops septemstriatus*, Schn.;—*T. crocotatus*, Id.;—*T. leucorhynchus*, Oppel, &c. Seb. I, vi, 4, is a species of this subdivision.

|| *Ang. lumbricalis*, Lacep. II, pl. xx, Brown, Jam. XLIV, 1, Seb. I, lxxxvi, 2;—*T. albifrons*, Opp. In this genus, as in all others where the species are very similar, the latter have not been well determined; it is well worthy of a monograph. We are acquainted with at least twenty species.

¶ *Typhlops philippinus*, Cuv. Eight inches long, all blackish. The *T. oxyrhynchus*, Schn., must be closely allied to it.

former are subdivided into the venomous with several maxillary teeth, and the venomous with insulated fangs.

In the non-venomous, the branches of the upper jaw as well as those of the lower one, and the palatine arches, are every where furnished with fixed and solid teeth; there are then four equal rows of these teeth in the upper part of the mouth, and two below*.

Those of the non-venomous, which have the mastoid processes comprised in the cranium, the orbit incomplete behind, and a thick, short tongue, still retain much similitude to the Double-walkers, *Amphisbænæ*, in the cylindrical form of their head and body; they were formerly united with the *Anguis*, on account of their small scales. They constitute the Rollers.

TORTRIX†, *Oppel*.

They are otherwise distinguished from the *Anguina*, even externally, inasmuch as the scales which form the range along the belly and under part of the tail are a little larger than the others, and the tail itself is extremely short. They have but one lung.

The species known are from America, the most common must be *Anguis scytale*, L., Seb. II, xx, 3. (The Ribbon). Two feet long, irregularly annulated, white and black‡. The

UROPELTIS, *Cuv.*,

Is a new genus allied to *Tortrix*, in which the tail is still shorter, and obliquely truncated above, the truncated surface flat, and studded with granules. The head is very small, the muzzle pointed; there is a range of scales along the belly somewhat larger than the others, and a double range of them under their stump of a tail§.

In those non-venomous Serpents, on the contrary, in which the mastoid bones are detached, and the jaws are susceptible of great dilatation, the occiput is more or less enlarged, and the tongue forked and very extensible.

* The common opinion respecting them is, that those which are destitute of the pierced fangs in front of the jaws are not venomous, but I have some reason to doubt its correctness. They all have a maxillary gland, which is frequently very large, and their back molars exhibit a groove which may serve to convey some fluid. It is very certain that several of the species in which the back molars are very large, are accounted extremely venomous in the countries they inhabit, and that the experiments of Lalande and Leschenault have served to confirm that opinion; the repetition of these experiments is much to be desired.

† They are the *ANILIUS*, Oken, the *TORQUATRIX*, Gray, and the *ILYSIA*, Hemprich and Fitzinger.

‡ Add, *Ang. corallinus*, Seb. II, lxxiii, 2, 1, 3, which is perhaps a mere variety of the *scytale*;—*Ang. ater*, Id. XXV, 1, and VII, 3;—*Tortr. rufa*, Merr., which seems to me a variety of the *atra*;—*Ang. maculatus* and *tessellatus*, Seb. II, c. 2;—*F. latta*, N. Seba, II, xxx, 3; Russel, XLIV;—*Tort. punctata*, Nob., Seb. II, 11, 1, 2, 3, 4, and VI, 1, 4.

§ *Uropeltis ceylanicus*, Nob.; *Urop. philippinus*; two new species, similar to the *Tortrices* even in colour.

They have long been divided into principal genera, BOA and COLUBER, distinguished by the simple or double plates on the under part of the tail. The genus

BOAS*, *Lin.*,

Formerly comprised all those Serpents, venomous or not, the under part of whose body and tail is furnished with uninterrupted, transverse scaly bands, and which have neither spur nor rattle at the end of the tail. As they are rather numerous, even after deducting from them the venomous Serpents, they are again subdivided.

The BOAS, properly so called, have a hook on each side of the anus, a compressed body, thickest in the middle, a prehensile tail, and small scales on the head, at least on its posterior portion. It is in this genus that are found the largest of all serpents; certain species attain a length of thirty or forty feet, and are able to swallow dogs, deer, and even, as some travellers state, oxen, after having crushed them between their folds, covered them with saliva, and enormously dilated their jaws and throat. This operation is very protracted. One remarkable peculiarity of their anatomy is, that their small lung is but half the length of the other.

The integuments of the head and jaws of these serpents furnish materials for a still further subdivision.

1. In some the head down to the tip of the muzzle is covered with small scales, similar to those on the body, and the plates on the jaws are not pitted. Such is the

Boa constrictor, L.; *Le Devin*, Lacep. II, xvi, 1; Seb. I, xxxvi, 5, liii, 11, lxxxviii, 5, xcix, 1, ci; *Devin* or *Boa empereur* of Daudin†. Known by a broad chain, which extends along the back, formed alternately by large, blackish, irregularly hexagonal spots, and by pale oval ones, the two ends of which are emarginate, constituting a very elegant object.

2. In others there are scaly plates from the eyes to the end of the muzzle, but no fossulæ on the jaws.

Boa scytale and *murina*, L.; *Anacondo*, Seb. II, xxiii, 1, and xxix, 1; *B. aquatica*, Pr. Max. liv. II. Brown; a double suite of round black spots along the back; ocellated spots on the flanks.

3. Others have scaly plates on the muzzle, and little pits of fossulæ on the lateral plates of the jaws.

* *Boa*, the name of certain Italian Serpents of great size, most probably the four striped Coluber, or Serpent of Epidaurus of the Latins. Pliny says they were thus named, because they sucked the teats of Cows. The Boa, 120 feet long, which it is pretended was killed in Africa by the army of Regulus, was probably a Python. See Pliny, lib. VIII, cap. xiv.

† Daudin thinks that the *Devin* is to be found in the eastern continent, but it is certainly from Guiana. Vaillant and Humboldt have procured it there. Pr. Max. has found it in Brazil. The two succeeding species were also brought from Surinam by M. Le Vaillant, and it is well known that the *Bojobi* inhabits Brazil. I do not think there is any large Boa, properly so styled, in the eastern world. The great Serpents of Africa and India are Pythons. The name *Devin* arises from the circumstance of having improperly applied to this Serpent what is stated respecting certain large Colubers, which constitute the Fetiches of some negro tribes.

Boa cenchris, L.: *Aboma* and *Porte Anneau*, Daud.; Seb. I, lvi, 4, II, xxviii, 2, and xcvi; *Boa cenchrya*, Pr. Max. liv. VI. Fawn-coloured, with a suite of large brown rings along the back, and variable spots on the flanks.

These three species, which attain a nearly equal size, inhabit the marshy grounds of the hot parts of America; attaching themselves by their tail round some aquatic tree, they dart their floating body upon the quadrupeds which come there to drink.

4. Some have plates on the muzzle, the side of the jaw being grooved so as to resemble a slit beneath the eye, and further back*.

5. Finally, there are others in which the fossulæ are wanting, but whose muzzle is furnished with slightly prominent plates, cut obliquely from behind forwards, and truncated at the end, so that they terminate in a wedge. Their body is greatly compressed, and their back carinated. These inhabit the East Indies, and may constitute a distinct subgenus†. Schneider has separated from the Boas his

PSEUDO-BOAS—SCYTALE, Merr.

Which have plates like the Coluber, not only on the muzzle, but also on the cranium; no fossulæ, a round body, and the head and trunk one uniform piece, as in Tortrix‡. Daudin also has separated it from the Erices, or

ERIX§, Daud.,

Which differ from the Pseudo-boas in their tail being very short and obtuse, and in the ventral scales being narrower. Their head is short, and nearly of one uniform piece with the body; these characters would approximate them to Tortrix if the conformation of their jaws did not forbid it; besides, the head is only covered with small scales. There is no hook near the anus. We may approximate to these the

ERPETON||, Lacep.

Erpetons, which are very remarkable for two soft prominences covered with scales borne by them on the end of the muzzle. The head is furnished with large plates, those on the belly have but little breadth, and the

* The *Boa broderie* (*B. hortulana*, L.), Séb. II, lxxxiv, 1, and the *élégant*, Daud. V, lxiii, 1, which is the same;—the *Bojubi* (*B. canina*, L.), Seb. II, lxxxv and xcvi, 2, or *Xiphosoma araramboja*, Spix, VI. The *B. hipnale*, Seb. II, xxxiv, 1, 2, and Lacep. II, xvi, 11, appears to be nothing more than a young *Bojubi*;—the *B. Merremii*, Schn., Merr. Beytr. II, ii, or *Xiphosoma dorsuale*, Spix, XV, of which Daud. has made his genus *CORALLE*, from the probably accidental and individual character of the two first plates under the neck being double.

† The *B. carinata*, Schn., or the *ocellata*, Opp.;—the *B. viperina*, Sh. Russel, pl. iv.—N. B. These two subdivisions form the genus *XIPHOSOMA*, Fitz., the *CENCHRIS* of Gray.

‡ *Scytale coronata*, Merr. Seb. II, xli, 1, Pr. M. liv. VII. N. B. The *Scytale* of Merrem must not be confounded with that of Daudin, which is the *Echis* of Merrem.

§ *Erix* (hair), a name applied by Linnaeus to a species of *Anguis*.

|| From the Greek, *Erpetos*, Serpent.

sub-caudal ones hardly differ from the rest; the tail itself, however, is long and pointed*.

COLUBER †, Lin.

The Snakes comprise all those Serpents, venomous or non-venomous, whose sub-caudal plates are divided in two, that is, which are arranged by pairs.

Independently of the subtraction of the venomous species, their number is so enormously great, that naturalists have had recourse to all sorts of characters to subdivide them. We may separate, in the first place,

PYTHON, Daud.

The Pythons, which have hooks near the anus, and narrow ventral plates, as in the Boas, from which these serpents only differ in the double sub-caudal plates on the under part of the tail. The end of the muzzle is furnished with plates, and their lips are pitted.

Some species are as large as any Boa: such is the *Ular-Sawa* or *Great Coluber of the Sunda Islands*, *Col. javanicus*, Sch., which has been found more than thirty feet in length. Seb. I, lxii; II, xix, 1; xxviii, 1; xcix, 2 ‡.

The last caudal plates in some of these Pythons, and the first in others, are simple §. This may sometimes be an accidental difference.

CERBERUS, Cuv.

Nearly the whole of the head, as in the Pythons, covered with small scales, and no plates but what are found between and before the eyes; but the hooks at the anus are wanting. Sometimes there are simple plates at the base of the tail ||.

XENOPELTIS, Reinwardt,

Have large triangular and imbricated plates behind the eyes, becoming confounded with the succeeding ones, which merely decrease in size ¶.

HETERODON, Beauv.,

Have the usual plates of a Coluber, but the end of the muzzle is one

* *Erpeton tentaculé*, Lacep. Ann. Mus. II, 1, a name given to this genus by Lacep., who first described it; Merrem has substituted RHINOPIRUS.

† *Coluber*, the Latin generic name for Serpents.

‡ This *Ular-sawa*, or *Python améthyste*, Daud., *Boa amethystina*, Schn., of which we possess one great skeleton and several skins, brought from Java by M. Leschenault, is at least closely allied to the *Pedda-poda* of Bengal (*Python tigre*, Daud.), Russel, XXII, XXIII, XXIV, *Col. boaformis*, Sh., *Boa castanea* and *albicans*, Schn.; and it appears to us that all the pretended species of Boa of the eastern continent are in fact Pythons. *Ular-sawa*, in the Malay language, signifies the River-Serpent. The *B. reticulata*, *ordinata*, *rhombeata*, Schn., are all Pythons.

§ The *Bora*, Russ. XXXIX (*Boa orbiculata*, Schn.).

|| We have seen these plates simple in one individual, and double in others of the same species, a proof of the little importance of this character. To this group belong the *Col. cerberus*, Daud., Russel, pl. xvii;—*Homolopsis obtusatus*, Reinw., and the neighbouring species.

¶ *Xenopeltis concolor*, Reinw.

single piece, short, and resembling in form a slightly elevated triedral pyramid, one ridge being above; from which circumstance they have been called Hog-noses*.

HURRIA, Daud.

These are small Colubers of India, in which the plates on the base of the tail are always simple, and those on the point double; these anomalies, however, merit but little attention†.

DIPSAS, Laurent.—BUNGARUS, Oppel,

Have the body compressed, much narrower than the head; scales of the spinal range larger than the others, a circumstance which we shall find again in Bungarus. Such is the

D. indica, Cuv.; *Colub. bucephalus*, Sh.; Seb. I, xliii‡. Black, ringed with white.

DENDROPHIS, Fitz.—ACHÆTULLA, Gray,

Have the scales of the spinal range larger, as in Dipsas, and those along the flanks narrower; but their head is not broader than the body, which is very long and slender: the muzzle obtuse§.

DRYNIUS, Merr.—PASSERITA, Gray,

Have the body as long and slender as in the preceding subdivision; but there is a little slender and pointed appendage to the end of the muzzle||.

DRYOPHIS, Fitz.,

Have the same thread-like form, the muzzle pointed, but no appendage; their scales are equal¶.

* The *Hétérodon noirâtre*, Beauv., *hétérodon*, Daud., and the *hétérodon tacheté* (*Cenchrus mokeson*, Daud.), belong to this genus; but Beauvois has established it on a character which is found in a great many Colubers, viz., that of the posterior maxillary teeth being the largest; and Daudin appears to have known his *Mokeson* by a drawing only, we mean the *Hog-nose* of Catesby, II, pl. lvi, which Daud. himself has cited. A part of its tail-plates is sometimes entire; but at the base, and not near the point, as Daud. describes it. Linnæus had correctly indicated this Serpent in his tenth edition, under the name of *Coluber constrictor*; why he changed it in the twelfth to *Boa constrictrix*, is not known (a).

† *Hurrial*, a barbarous name, taken from that which designates the species, Russ. XI, copied Daud. V. xlvii, 2. Another, Merr. II, iv.

‡ *Dipsas*, the Greek name of a Serpent whose bite was thought to cause a fatal thirst, from the Greek word *dipsa*, thirst. The fig. of Conrad Gesner, at the word *dipsas*, is precisely of this subgenus. The *Dip. indica* is altogether different from the *Vipera atrax*, Mus. Ad. Fred. XXII, 2, with which Linnæus, Laurentini, and Daudin have confounded it.

§ *Col. achætulla*;—*Col. decorus*, Shaw;—*Col. caracaras*, Id. (*Bungarus filiformis*, Oppel.), to which I add the *SERPENS*, Fitz.; at least in the *Col. catenulatus*, Russ. pl. xv, the dorsal scales are rhomboidal and larger, as in the *achætulla*.

|| *Col. nasutus*, Russ. Serp. pl. xii and xiii.

¶ *Col. fulgidus*, Daud. VI, lxxx; Seb. II, liii, 9;—*Dryinus æneus*, Spix, III.

(a) The author in this note has confounded three species of Serpents which are not distinct—the *Hétérodon*, the *Trigonocephalus tisiphone* or *Mokeson Snake*, and the *Coluber constrictor* or *Black Snake*. The *Heterodon* is a harmless animal, and has the plates on the top of the head arranged, 3, 2, 3, 2.—ENG. ED.

OLIGODON, Boié.

Small Colubers, with a short, narrow, obtuse head, in which the palatine teeth are wanting.

The various remaining subgenera which have been separated from that of Coluber, appear to us less worthy of being retained; they are founded upon slight variations in the proportions of the head, thickness of the trunk, &c.* After all these divisions, the Colubers are more numerous in species than any other genus of Serpents. Several are found in France. Such as

Col. natrix, L.; *Couleuvre à collier*, Lac. II, vi, 2. (The Ringed Snake). Cinereous, with black spots along the flanks, and three white ones on the neck, forming a collar; scales carinate, that is to say, raised into a ridge. Very common in meadows and stagnant waters; it feeds on frogs, insects, &c., and is eaten in several of the provinces.

There is a closely allied species in Sicily, which is much larger, and has a black collar, the *Col. siculus*, Nob.

Col. viperinus, Latr.; *La Viperine*. Grey-brown; a suite of black spots forming a zigzag along the back, and another of smaller ocellated ones along the sides, a kind of colouring which gives it a resemblance to the Viper; beneath chequered with grey and black; scales carinated.

Col. austriacus, Gm.; *La Lisse*, Lacep. II, ii, 2. Brown-red; marbled beneath with steel-colour; two ranges of small blackish spots along the back; scales smooth, each with a small brown dot near the point.

Col. atro-virens; *La verte et jaune*, Lacep. II, vi, 1. Spotted with black and yellow above; beneath of a greenish yellow; scales smooth.

The south of France and Italy produce,

Col. girondicus, Daud.; *La Couleuvre Bordelaise*, which has nearly the same colours as the *viperinus*, but the scales are smooth, and the dorsal spots smaller and more apart.

Col. elaphis, Sh.; *La Quatre-Raies*, Lacep. II, vii, 1. Fawn-colour, with four brown or black lines on the back. It is the largest of the European serpents, and sometimes exceeds six feet. We have reason to think it is the *Boa* of Pliny.

Col. Æsculapii†, Sh. (The Serpent of Æsculapius). Stouter

* By this I particularly mean the TYRIA, MALPOLON, PSAMMOPHIS, CORONELLA, XENODON, and PSEUDOELAPS of Fitzinger. At most, we could only adopt his DUBERRIA, where the head is short, obtuse, and on one uniform line with the body, as in ELAPS; and his HOMALOPSIS, in which the eyes are rather more vertical than in the other Colubers. Observe that I have separated CERBERUS from them. Laurentini had previously endeavoured to divide the Colubers into COLUBER and CORONELLA; the latter were those in which the scales on the sides of the temporal plates are large enough to be counted as so many plates more; but the transitions from one group to another are almost insensible.

† N.B. The *Col. Æsculapii*, Lin., is a very different, and an American species.

than the elaphis, but not so long; brown above; straw colour beneath and on the flanks; dorsal scales nearly smooth. Found in Italy, Hungary, and Illyria. It is represented by the antients in their statues of Æsculapius, and the Serpent of Epidaurus was probably of this species.

The Colubers, foreign to Europe, are innumerable; some are remarkable for the vividness of their colours, others for the regularity of their distributions; the tints of several are tolerably uniform. But few of them attain a very large size*.

ACROCHORDUS, *Hornstedt*,

Are easily distinguished by the little uniform scales which cover the head and body, both above and beneath. In the species known,

A. javensis, Lac. II, xi, 2; *Anguis granulatus*, Schn.; *Oular caron* of Java; each of the scales is relieved with three small ridges, which, when the skin is well stuffed, resemble insulated tubercles. It attains a large size. Hornstedt erroneously states it to be frugivorous—which would be a very singular habit for a serpent†.

Venomous Serpents, par excellence, or those with isolated fangs, have a very peculiar structure in their organs of manducation.

Their superior maxillary bones are very small, borne on a long pedicle, analogous to the external pterygoid process of the sphenoid bone, and are very moveable; in them is fixed a sharp pointed tooth, pierced by a canal, through which flows a liquor secreted by a large gland, situated under the eye. It is this liquor which, poured into the wound made by the tooth, carries the destructive influence into the bodies of animals, and there produces effects which are more or less violent, according to the species of the reptile in which it is secreted. This tooth, when the animal does not wish to use it, is concealed in a fold of the gum, and behind it are several germs destined to replace it, in the event of its being broken in a wound.

* The Colubers presenting but few variations of structure that are interesting, I have not thought it necessary to give in this place the long catalogue. It will be found in the works of Merrem, Gmelin, Daudin, and Shaw. It is necessary, however, to consult them with much caution and critical nicety: they abound in transpositions of synonymes, &c. For instance, the *Col. viridissimus* and the *Col. janthinus*, Merr. I, xii, only differ from the effects of the spirit of wine;—the *Col. horridus*, Daud. Merr. II, x; (*Col. viperinus*, Shaw), is the same as the *demi-collier*, Lac. II, viii, 2;—the *Coul. violette*, Lacep. II, viii, 1, and the *Col. reginæ*, Mus. Ad. fr. XIII, 2, only differ by the action of the spirit. Such, also, should be considered the *Col. lineatus*, Seb. XII, 3; Mus. Ad. fr. XII, 1, xx, 1;—the *Col. jaculatrix*, Seb. I, 9, Scheuchz., DCCXV, 2;—the *Col. atratus*, Seb. I, 9, ix, 2, and even the *terlineatus*, Lacep. II, xiii, 1;—the *Col. sibilans*, Seb. I, ix, 1, II, lvi, 4; and the *Coul. chapelet*, Lacep. II, xii, 1, appear equally alike, as well as the *Col. Æsculapii*, Jacq. and the *flavescens*, Scopol., &c. &c. &c. As to the transposition of synonymes, they are innumerable. N.B. The ENHYDRUS of Daud. would be non-venomous Colubers, with a compressed tail, but the only species he cites, *Anguis xyphura*, Hern. aff. an. p. 269, and Obs. Zool. p. 288, is evidently a Hydrophis or a Pelamis.

† We have never been able to discover the particular bone Oppel says he observed in the Acrochordus, as taking the place of the poison-fangs, and M. Leschenault assures us that the Acrochordus is harmless.

These venomous teeth have been termed by naturalists moveable fangs, but in fact it is the maxillary bone which moves; there are no other teeth in it, so that in this kind of dangerous serpents only the two rows of palatine teeth are to be seen in the upper part of the mouth.

All the venomous species, whose mode of production has been accurately determined, bring forth living young ones, as their eggs are hatched without being laid, from which circumstance is derived their common name of *Vipers*, a contraction of viviparous.

Venomous serpents with insulated fangs have external characters very similar to those of the preceding ones, but in the greater number the jaws are very dilatable, and the tongue very extensible. The posterior portion of their head being broad, generally gives them a ferocious aspect, which is a partial indication of their disposition. They form two great genera, *CROTALUS* and *VIPERA*, the second of which has been variously subdivided, and some smaller ones group around them.

CROTALUS *, *Lin.*

Rattlesnakes are celebrated above all other Serpents for the intensity of their poison. Like the Boas, they have transverse simple plates under the body and tail; but their most distinguishing character is the rattle which they carry at the end of the tail, and which is formed by several scaly cornets loosely fitted into each other, and which move and produce the peculiar noise or rattle whenever they crawl or shake their tail. The number of these cornets increase with age, an additional one being always found after each moult. There is a little round indentation or pit behind each nostril†. All these species whose habitat is well ascertained are from America. The danger resulting from the bite of these noxious reptiles is in proportion to the warmth of the climate or of the season; their natural disposition, however, is in general tranquil, and sufficiently dull, and they are rather slow and heavy in their motions, never biting unless provoked, or to kill the prey on which they feed.

Although the Rattlesnake never ascends trees, its principal food consists of birds, squirrels, &c. It has long been supposed that it possesses the faculty of rendering them powerless by its breath, or even of *charming* them, that is to say, to force them by a single glance to drop into their mouths; this, however, is not so, and the reptile in question seizes its prey while under the agitation and terror produced by its appearance‡.

In most of the species there are scales on the head similar to those on the back.

Crot. horridus, L.; Catesb. II, xli, (The Diamond Rattlesnake), is the species most common in the United States; brown, with irre-

* *Crotalus*, from the Greek word *crotalon*.

† See Russell and Home, Phil. Trans. 1804, pl. iii, p. 76.

‡ See Barton, "Memoir on the Power of Fascination attributed to the Rattlesnake," Philad. 1796.

gular blackish transverse bands. That of Guiana, *Crot. durissus**, Lacep. II, xiii, 2, (The Banded Rattlesnake), has lozenge shaped spots edged with black, and four black lines along the top of the neck; both species are equally to be dreaded, as death speedily follows a wound from their fangs. They are sometimes found six feet in length(a).

The head of some species is furnished with large plates†.

We should approximate to the Rattlesnakes the

TRIGONOCEPHALUS, *Oppel*.—BOTHROPS, *Spix*.—COPHIAS, *Merr*.

Which, however, are distinguished from them by the want of a rattle, but having the same pits behind the nostrils, and being at least equally as venomous.

The sub-caudal plates in some of them are simple, as in the Rattlesnake, their head being covered with plates to behind the eyes; their tail terminates in a small horny spur‡. Such is the

Colub. tisiphone, Shaw; Catesb. II, xliii and xliv. (The Brown Viper of Carolina). Brown, clouded with spots of deeper brown.

In others the sub-caudal scales are double, and the head is covered with scales similar to those on the back§. Such among others is

Trig. lanceolatus, Opp.||; *Serpent jaune des Antilles*, Lacep. II, v, 1. (The Lance-headed Viper). The most dangerous reptile of the French Sugar islands; it is yellowish or greyish, more or less varied with brownish, and attains the length of six and seven feet; it lives among the sugar-canes, where it feeds on rats, and occasions the death of many of the negroes**.

The head of some of these Trigonoccephali with double sub-caudal scales is furnished with plates††.

Others, along with the small scales on the head, have double plates be-

* These names of *durissus* and *horridus* have been variously applied to these two species.

† It is this subdivision which furnished M. Gray with his genus CROTALOPHORUS, and M. Fitzinger with that of *Caudisona*. The *Crot. miliaris*, L., Catesb. II, xlii, belongs to it.

‡ They are the *TISIPHONE* of Fitzinger.

§ In the work of M. Fitzinger, this division is called CRASPEDOCEPHALUS; all the BOTHROPS, Spix, pl. xix—xxiii, belong to it.

|| This species inhabits Brazil, and most probably other parts of South America; I am even inclined to think it is the *Souroucou* of Spix, pl. xxiii, which he considers the *Crot. mutus* or *lachesis*.

** Here comes the *Trimérésure vert*, Lacep. An. Mus. IV, lvi, 2, or *Boodropam*, Russel, Serp. Corom. IX, which sometimes has two or three entire plates under the root of the tail; this, however, is but an individual accident. Add, *Cophias bilineatus*, Pr. Max. No. V;—*C. atrox*;—*C. jacaraca*.

†† Fitzinger appropriates the name of TRIGONOCEPHALUS to this subdivision.

(a) These two Rattlesnakes are common to the United States. There is a third, the *H. miliaris*, in that country, though the most dangerous, it can make no noise with the cornets, which are furnished equally as in the other Snakes.—
ENG. ED.

neath the tail, with the exception of the very extremity, which is merely furnished above and beneath with small imbricated scales, and terminates in a little spur*. Of this number is the

Crot. mutus, L.; *Col. alecto*, Sh.; Seb. II, lxxvi, 1; *Lachesis rhombeata*, Pr. Max. No. V. Yellowish; the back marked with large black or brown lozenges; scales raised in the middle. It is found six and seven feet long, and is quite as formidable as the Rattlesnakes.

VIPERA, Daud.

The Vipers, most of which were confounded with the Colubers by Linnæus, on account of their having also the double sub-caudal plates, require to be separated from them from the circumstance of their having poisonous fangs. There are also some serpents which naturally belong to this division, whose sub-caudal plates are either wholly or partially simple. They are all distinguished from the Rattlesnakes and the Trionocephali by the absence of the pits behind the nostrils.

In some the head is only furnished with imbricated and carinated scales like those on the back†. Such is

Vip. brachyura, Cuv.; Seb. II, xxx, 1. (The Minute Viper). The intensity and activity of its poison render it one of the most terrible of the genus‡.

In the Adders the head is covered with small granulated scales, as for instance,

Col. berus, L. (The Common Viper). Brown; a double row of transverse spots on the back; a range of black or blackish spots on each flank. Sometimes the dorsal spots coalesce in transverse bands, and at others they all form one zig-zag longitudinal band, in which state it is the *Colub. aspis*, L.§, which is sometimes called *Aspic* in the neighbourhood of Paris. Individuals are found perfectly black||.

Vip. illyrica, Aldrov. 169; *Col. ammodytes*; *La Vipère à museau cornu*, Jacquin. Collect. IV, pl. xxiv and xxv. Very nearly similar

* It is the genus *LACHESIS*, Daud., adopted by Fitzinger, but badly characterized; the sub-caudal plates are certainly double, almost to the very end, where there is nothing but very small scales. Pr. Max. gives a correct view of it.

† This, with the following division, forms the subgenus *ECHIDNA* of Merrem, which, with his *Echis*, of which we shall speak hereafter, composes his genus *VIPERA*. Fitzinger arranges our three first divisions in three genera, which he names *VIPERA*, *COBRA*, and *ASPIS*.

‡ Add the *Aspic*, Lacep. II, ii, 1, (*Vip. ocellata*, Lath.), a large species allied to the *atropos*, Lin. Mus. Ad. Fred. XIII; but very different from the *aspis* of Linnæus, which is a mere variety of the common species;—*Vip. Clotho*, Seb. II, xciii, 1;—*Vip. lachesis*, Id. XCIV, 2;—the *Daboie*, Lacep, II, xiii, 2, or the *brasilienne*, Id. IV, 1;—the *Vip. élégante*, Daud. Russel, VII, &c.

§ *Aspis*, a Serpent of Egypt, of which there were several species. One of them, from the dilatibility of its neck, must have been the *Haje*.

|| *Berus* is the name of a serpent only used by the authors of the middle century, such as Albert, Vincent de Beauvais, &c., and then for an aquatic species, probably the *Col. natrix*. The *Vipère de Charas*, of which Laurenti endeavoured to make a species, and which is the *Col. aspis*, Gmel., is the same as this common Viper, which, in my opinion, is the true *berus* of Linnæus, who on this point only cites Aldrov. 115, which is this species.

to the common species, but particularly distinguished from it by a small soft horn covered with scales that projects from the end of its muzzle. It is found in Dalmatia, Hungary, &c.

Col. cerastes, L.; *Le Ceraste*, Lacep. II, 1, 2. Remarkable for a small pointed horn on each eye-brow; it is greyish, and hides itself in the sand, in Egypt, Lybia, &c. It is often mentioned in the writings of the antients.

Vip. lophophris, Nob.; *Vipère à panache*, Voy. de Patterson, pl. xv. A little bundle of short horny threads on each eye-brow instead of the horn. From the environs of the Cape.

Other Vipers, similar in general to the preceding ones, have three plates, somewhat larger than those which surround them, on the middle of the top of the head*.

Col. cherssea, L.; *Col. berus*, Laurent. and Daud. Very similar to the common Viper, and distinguished from it by the aforesaid three plates. It is a rarer and smaller species, and said to be more venomous†.

Some individuals are almost entirely black, called *Black Vipers*—*Colub. prester*, Laurent. pl. iv, f. 1 ‡.

Next come those Vipers in which the head is furnished with plates almost like that of the Colubers.

Of this number some are so exactly similar to the most common Vipers, that there is nothing but these plates to distinguish them§. Such is,

Col. hæmachates, L.; Seb. II, lviii, 1, 3.‡ A Cape Serpent. Reddish-brown, marbled with white; muzzle obliquely truncated beneath.

THE NAIAS

Are Vipers with the head furnished with plates, and the anterior ribs susceptible of being raised up and drawn forwards, so as to dilate that part of the trunk into a disk more or less broad. The most celebrated species is the

Col. naia, L.; *Naia tripudians*, Merr.; *Serpent à lunettes*, or *Cobra capello* of the Portuguese in India; Seb. II, 85, 1, 89, 1—4, &c.; Lacep. II, iii, 1, (The Cobra de Cabello, or Spectacled Viper), so called from a black line resembling the figure of a pair of specta-

* This subdivision has furnished Merrem with his genus *PELIAS*.

† It is the *Æsping* of the Swedes (*æsping*, corruption of *aspic*), undoubtedly figured in the Stockhol. Mem. 1749, pl. vi. Laurenti, however, Spec. Medic. p. 97, and pl. ii, f. 1, has applied it to the name of *berus*. It is also the *Pelias berus*, Merr.; *Vip. berus*, Fitzinger.

‡ *Presther*, the Greek name of a serpent, considered by several authors as identical with the *dipsas*, from *Prethein*, to burn.

§ Merrem has formed his genus *SERPEDON* from this subdivision. Add, *Col. V. nigrum*, Scheuchz. Phys. Sacr. IV, DCCXVII

N. B. The *Ophis*, Spix, Serp. XVII, must be a venomous serpent, similar to these Serpedons, but one whose poison fangs are preceded by some small simple teeth. Not having seen his species, I fear it is one of those Colubers with large posterior maxillary teeth before mentioned, several of which are at least liable to the suspicion of being poisonous.

cles traced on the widened portion of its disk. It is extremely poisonous, but it is said that the root of the *Ophiorhiza mungos* is a sure antidote against the effects of its bite. The jugglers of India tame and teach it to dance, having previously extracted the fangs. The same use is made of another species in Egypt, the

Col. haje, L.; *L'Haje*, Geoffr., Egypt. Rept. pl. vii; and Savign. Id. Suppl. pl. iii, whose neck is not so wide, and which is greenish bordered with brownish. The jugglers of that country, by pressing on the nape of the neck with their finger, throw it into a kind of catalepsy, which renders it stiff and immoveable, (*this is the turning of it into a rod*). Its habit of raising itself up when approached, induced the antient Egyptians to believe that it was the guardian of the fields it inhabited. They made it the emblem of the protecting divinity of the world, and sculptured it on each side of a globe upon the gates of their temples. There is no doubt that it is the serpent described by the antients under the name of the *Asp of Egypt*, *Asp of Cleopatra*, &c.

ELAPS*, Schn. (part of),

Are Vipers with a head furnished with plates, very differently organized from the *Naïæ*. They are not only deprived of the power of dilating their ribs, but they cannot even dilate their jaws, on account of the shortness of the tympanal bone, and particularly of the mastoid ones, the result of which is, that their head, like that of the *Tortrices* and *Amphisbænæ*, is of one uniform piece with the body. The most common species is

Col. lemniscatus, L.; Seb. I, x, ult. and II, lxxvi, 3. A white ground marked with triple black rings; tip of the muzzle black. It inhabits Guiana, where it is greatly dreaded, and where it causes an equal degree of fear to the *Tortrix scytale*, and the *Coluber Æsculapii*, although they are harmless, in consequence of their resemblance to it in form, size, and colours. There are several species of Elaps in the two continents with a nearly similar distribution of colours †.

MICRURUS, Wagl.

Are Elaps with a very short tail.

PLATURUS, Lat.

Have the head enveloped with plates, and double ones under the tail; the latter, however, is compressed in the form of an oar, which renders them aquatic ‡.

* Schneider comprised among his Elaps all the serpents he supposed to be deficient in a separated mastoid bone, but of this he judged from external appearances, or the small degree of enlargement in the occiput; this character, therefore, is only true in the *Tortrices* of Oppel or Hysia. He paid no attention either to their scales or their venom. *Elaps*, *Elops*, are the Greek names of a non-venomous serpent.

† Such are *E. anguiformis*, Schn.;—the *Vip. Psyché*, Daud. VIII, c. 1;—*Col. lacteus*, Lin. Mus. Ad. Fr. XVII, 1, and better, Seb. II, xxxv, 2;—*El. nob. surinamensis*, Seb. II, vi, 2, and lxxxvi, 1;—*Col. latonius*, Merr. I, 2. and Seb. II, xxxiv, 4, and xliii, 3, the same as the *Col. lubricus*;—*Col. flavius*; &c.

‡ *Le Plature à bandes* (*Col. laticaudatus*, L., or *Hydrus colubrinus*, Sh.), Daud. VII, lxxxv.

Finally, there are some serpents which should be placed next to the vipers, only differing from them in their sub-caudal plates, some or all of which are simple. They are distinguished from the *Tisiphones* by having no pits behind the nostrils.

Sometimes the plates on the base of the tail are entire.

TRIMERESURUS, Lacep.

Large plates on the head; part of their plates double, the others simple*.

OPLOCEPHALUS, Cuv.

Large plates on the head; all the sub-caudals simple†.

ACANTHOPHIS, Daud.—OPHRIAS, Merr.

Plates on the fore-part of the cranium and head; tail terminated by a hook; almost all its scales simple, the extreme sub-caudal ones sometimes double‡.

ECHIS, Merr.—SCYTALE, Daud.

The head covered with small scales; all the sub-caudal plates simple§.

LANGAHA, Brug.

Head covered with plates; muzzle salient and pointed; anterior half of the tail completely encircled with entire rings, and the posterior covered above and beneath with small imbricated scales||.

In addition to these two tribes of Serpents, properly so styled, a third has lately been recognized, in which the organization and armature of the jaws are nearly the same as in the non-venomous serpents, but in which the first maxillary tooth is larger than the others, and is perforated for the transmission of the poison, as in the venomous serpents with isolated fangs.

These serpents form two genera, distinguished, like those of the two neighbouring families, by the covering of the belly and the under part of the tail.

BUNGARUS¶, Daud. partim,—PSEUDOB OA, Oppel.

The Bongares have, like the Boas, *Crotalus*, and *Echis*, subventral and subcaudal plates, simple head, short, and covered with large plates;

* The *Trimérésure à petite tête*, Lacép. Am. Mus. IV, lvi, 1.

† The species are new.

‡ *Acanthophis cerastinus*, Daud. V, lxxvii; and Merr. Beytr. II, ix, or *Boa palme-brosa*, Sh.;—*Ac. Brownii*, Leach, Zool. Miscell. I, iii, the most venomous reptile that is found in the environs of Port Jackson.

§ *Horatta pam.*, Russel, II, pl. 2, or *Boa horatta*, Sh., or *Pseudoboa carinata*, Schn., or *Scytale bizonata*, Daud. V, lxx;—*Pseudoboa krait*, Schn., or *Scytale krait*, Daud.

|| The *Langaha* of Madagascar, Lacép. I, xxii, a serpent only known by the figure of Bruguière.

¶ *Bungarus*, a barbarous term drawn from that of *Bungarum-panma*, the name by which the largest species is known in Bengal.

occiput but slightly enlarged. Their most distinguishing character is a longitudinal range of scales on the back, which is strongly carinate, broader than the lateral ones, as in *Dipsas*. These serpents are all from India, where they are termed *Rock Snakes*. One species attains a length of seven or eight feet*.

HYDRUS†, Schn., partim.—HYDROPHIS and PELAMIS, Daud.

Have the posterior part of the body and tail strongly compressed, and much raised vertically; a circumstance which, by enabling them to swim, renders them aquatic. They are very common in certain latitudes of the Indian Ocean. On account of their (nearly all) small scales, Linnæus classed such of them as he knew with the *Anguines*. Daudin has subdivided them as follows:

HYDROPHIS‡.

Have a range of scales on the belly somewhat larger than the others, as in *Tortrix*; head small, not inflated, obtuse, and furnished with large plates. Several species have been found in the salt-water canals of Bengal, and others in the Indian Ocean§.

PELAMIS.

The *Pelamides* have large plates on the head, but their occiput is inflated on account of the length of the pedicles of the lower jaw, which is extremely dilatable; all the scales on the body are equal, small, and arranged in compact hexagons.

The species most known, *Anguis platyrus*, L.; *Hydrus bicolor*, Schn.; Seb. II, lxxvii, 2; Russel, xli, is black above, yellow beneath. Although excessively venomous, it is eaten at Otaheite.

To these two subgenera I have added,

CHERSYDRUS||, Cuv.

Whose body and head are covered with small scales. Such is

Acrochordus fasciatus, Shaw; the *Oular-limpé*, Rept. pl. cxxx.

A very venomous serpent, found on the bottom of rivers in Java¶.

* The *Bongare à anneaux*, Daud. V, lxxv, *Boa fasciata*, Schn., copied from Russel, III.—Add, the *Bong. bleu*, *Boa lineata*, Sh. Russ. I.

† *Hydrus*, the Greek name of an aquatic serpent, perhaps of our common *Coluber*; but the *Hydrus marinus* of Ælian is precisely of this genus.

‡ *Hydrophis*, Water Serpent.

§ See the *Hydrophis* of Russel, Serp. Corom. pl. xlii, and part II, pl. vi—x. Add, the *H. curtus*, Sh., the *H. spiralis*, Id. pl. 125;—the *Leyoselasma* and the *Disteyre*, Lacép. An. Mus. IV, also belong to the subgenus *Hydrophis*; I even think the latter is the *Hydrus major*, Sh. pl. 124. They also are Serpents of the Indian Ocean, venomous, and possessed of several maxillary teeth.

N. B. I cannot agree with M. Fitzinger as to the harmlessness of the *Pelamides* and the *Disteyres*; on the contrary, I have fully ascertained their poison gland and fangs to be organized like those of a *Hydra* or a *Bungarus*. As to the *Aispysure*, Lacép. An. Mus. IV, I have not been able to procure it.

|| *Chersydros*, the Greek name of the *Col. natrix*.

¶ The *Hydrus granulatus*, Schn., must be closely allied to it.

N. B. The *H. caspius*, *enhydrys*, *rhynchops*, *piscator* and *palustris*, Schn., are mere common Vipers and Colubers. His *Hydrus colubrinus* is the Banded *Platurus*.

FAMILY III.



NAKED SERPENTS.

Our third and last family of the Serpents or Ophidians, that of the Naked Serpents, consists of but one very singular genus, which several naturalists have thought fit to refer to the Batrachians, although we are ignorant as to the fact of its undergoing any metamorphosis. It is the

CÆCILIA*, *Lin.*

So called because its eyes, excessively small, are nearly hidden beneath the skin, and sometimes are wanting. The skin is smooth, viscous and furrowed by annular plaits or wrinkles; it is apparently naked, but on dissection we find, in its thickness, perfectly formed though delicate scales, regularly arranged in several transverse rows between the folds of the skin†. The head is depressed; the anus round and nearly at the end of the body; the ribs much too short to surround the trunk: the articulation of the bodies of their vertebræ is effected by hollow conical facets filled with a gelatinous cartilage, as in Fishes and in some of the last of the Batrachians; the cranium is united to the first vertebra by two tubercles, as is the case in the Batrachians, which are approximated in this respect only by the *Amphisbæne* among the serpents; their maxillary bones cover the orbit, which resembles a very small hole, and those of the temples the temporal depression, so that the head above presents one continuous bony buckler; the hyoid bone, composed of three pairs of arches, might induce us to suppose that at an early period it is furnished with branchiæ. The maxillary and palatine teeth are arranged on two concentric lines, as in *Proteus*; but they are frequently sharp, and curved backwards, like those of serpents, properly so styled. The nostrils open behind the palate, and as the tympanal bone is fixed along with those that compose the cranial shield, there is no moveable pedicle to the lower jaw.

The auricle of the heart of these animals is not so deeply divided to induce us to consider it as double, but their second lung is as small as in other serpents; the liver is divided into a great number of transverse lamellæ. Vegetable matters, earth and sand, are found in their intestines. The only small bone contained in the ear is a little plate on the fenestra ovalis, as in the Salamanders.

Some of them have an obtuse muzzle, relaxed skin, deep wrinkles, and two small ciliar near the nostrils. Such is

Cæcilia annulata, Spix, xxvii, 1. Blackish, with eighty and odd plicæ marked with white circles; teeth conical. Found in Brazil, where it lives in marshes several feet beneath the surface.

* *Cæcilia*, the Latin for the Greek *tuphlos*, is the name of the Slow-worm (*Orvet*), which in several parts of Europe is still called *blind*, although it has very fine eyes.

† A fact I have ascertained in the *C. glutinosa*, the *White-bellied Cæcilia*, &c.

C. tentaculata, L.; Amen. Acad. I, xvii, 1. One hundred and thirty and odd plicæ, every other pair of which, particularly near the tail, does not completely encircle the body. It is black, marbled with white on the belly*.

Others have a much greater number of plicæ, or rather of close, transverse striæ.

Cæc. glutinosa, L.; Seb. XXV, 2; and Mus. Ad. Fred. IV, 1, is of that number, having three hundred and fifty plicæ, which unite beneath at an acute angle. It is blackish, with a longitudinal yellowish band along each flank. Found in Ceylon†.

Finally, there are some in which the plicæ are almost effaced; their body is very long and slender, and their muzzle salient. One species is completely blind, the *Cæc. lumbricoides*, Daud. VIII, xcii, 2; it is blackish; two feet in length, and about the thickness of a goose-quill‡.

ORDER IV.

THE BATRACHIANS§.

THE Batrachians have a heart composed of but one auricle and one ventricle. They all have two equal lungs, to which are joined in the earliest age branchiæ, that have some affinity with those of Fishes, and which have cartilaginous arches on each side of the neck attached to the hyoid bone. Most of them lose these branchiæ, and the apparatus which supports them, when they attain their perfect state. Three genera only, Siren, Proteus, and Menobranchus, retain them for life.

As long as these branchiæ remain, the aorta is divided at its origin into as many branches on each side as there are branchiæ. The branchial blood is brought back by veins which unite near the back in one arterial trunk, as in Fishes. It is from this trunk, or immediately from the veins

* This Cæcilia is not more tentaculated than others of its subdivision. Add, *C. albiventris*, Daud. VII, xcii, 1: if it is not the same as the *tentaculata*;—*C. interrupta*, Cuv., in which the white lines of the rings do not correspond with each other beneath;—*C. rostrata*, Cuv., with a more pointed muzzle, and no white edges to the rings. It is hard to say why Spix attributes upwards of two hundred plicæ to his *annulata*; his figure shews but about eighty.

† It is certainly from Ceylon, although Daudin places its habitat in America; as we have received it from the former country through the politeness of M. Leschenault; a closely allied species, it is true, inhabits the latter—*Cæc. bivittata*, Cuv.

‡ Linnæus mentions it, Mus. Ad. Fred. V, 2, but confounds it with the *tentaculata*. We have the skeleton of a Cæcilia more than six feet long, and having two hundred and twenty-five vertebræ, but of whose external characters we are ignorant.

§ From the Greek word *Batrachos* (Frog), animals analogous to Frogs.

which form it, that arise most of the arteries which nourish the body, and even those which conduct the blood to be respired in the lungs.

In those species, however, which lose their branchiæ, the arterial branches distributed through them become obliterated, with the exception of two, which, by their union, form a dorsal artery, giving each a small branch to the lungs. It is the circulation of a fish metamorphosed into that of a reptile. Batrachians have neither scales nor shell; a naked skin invests their body*, and, one genus excepted, they have no nails to their toes.

The envelope of the eggs is simply membranous; the female is impelled by the male to lay them, and, in many species, they are only fecundated at the moment of their expulsion. These eggs become greatly enlarged in the water after being laid. The young do not only differ from the adult in the presence of the branchiæ; their feet are developed by degrees, and in several species there are a beak and tail, which they subsequently lose, and intestines of a different form.

Some species are viviparous.

RANA, *Lin.*

Frogs have four legs in their perfect state, but no tail. Their head is flat, muzzle rounded, and the opening of their jaws large; the tongue in most of them is soft, and not attached to the bottom of the gullet, but to the edges of the jaw, and folds inwards. There are but four toes to the anterior feet; the hind ones frequently exhibit the rudiment of a sixth.

There are no ribs to their skeleton, and a prominent cartilaginous plate supplies the place of a tympanum, and renders the ear visible externally. The eye is furnished with two fleshy lids, and a third, which is transparent and horizontal, concealed under the lower one.

Inspiration is solely effected by the muscles of the throat, which, by dilating, receive air from the nostrils, and by contracting while the nostrils are closed by the tongue, compel that air to enter the lungs. Expiration, on the contrary, is produced by the muscles of the lower part of the abdomen: thus, if we open the belly of one of these animals while alive, the lungs dilate without being able to contract, and if we force another to keep its mouth open, asphyxia is the consequence, as it is no longer able to renew the air in its lungs.

The embraces of the male are long continued. His thumbs are furnished with a spongy enlargement, which increases during the nuptial season, and assists in attaching him to the female. He fecundates the ovum at the moment of its expulsion. The little animal that is produced from it is called a Tadpole; it is at first furnished with a long fleshy tail, and a small horny beak, having no other apparent limbs than little fringes on the sides of the neck. In a few days these disappear, and Swammerdam assures us that this is owing to their withdrawing under the skin, to

* M. Schneider has proved that the *Scaly Frog* of Walbaum only appeared so from accident, a few scales from some Lizards that were kept in the same jar having adhered to its back. Schn. Hist. Amphib. Fasc. I, p. 168.

form there the branchiæ. These latter are numerous small tufts attached to four cartilaginous arches, placed on each side of the neck, adhering to the hyoid bone, and enveloped in a membranous tunic, which is covered by the general skin. The water which enters the mouth, passing through the intervals of the cartilaginous arches, makes its exit, sometimes by two openings, and at others by one, situated either in the middle or left side of the external skin, according to the species. The hind feet of the Tadpole are very gradually and visibly developed; the fore feet are also developed, but under the skin, through which they subsequently penetrate. The tail is gradually absorbed. The beak falls and discloses the true jaws, which at first were soft, and concealed beneath the skin; and the branchiæ are annihilated, leaving to the lungs alone the function of respiration in which they participated with those lungs. The eye which at first could only be discerned through a transparent spot in the skin of the Tadpole, is now visible with its three lids. The intestines, which, in the beginning were very long, slender, and spirally arranged, become shortened, and acquire the enlargements requisite for the stomach and colon; for the Tadpole feeds solely on aquatic plants, and the adult animal upon insects and other animal matters. Tadpoles reproduce their limbs almost like Salamanders.

The period at which each of these changes takes place varies with the species.


In cold and temperate climates, the perfect animal passes the winter under ground, or in mud under water, without eating or breathing, though if we prevent it from respiring during the summer for a few minutes by keeping its mouth open, it dies.

RANA, *Laur.*

Frogs, properly so called, have a long tapering body; the hind feet extremely long, strong, and more or less perfectly palmated; the skin smooth; upper jaw furnished all round with a row of small fine teeth and an interrupted transverse range of them in the middle of the palate. On each side of the head of the male and below the ear is a thin membrane, which becomes distended with air when he croaks. These animals leap and swim well.

R. esculenta, L.; Rœsel. Ran. pl. xiii, xiv. (The Green Frog). A fine green spotted with black; three yellow streaks on the back; belly yellowish. A common species in Europe in all stagnant waters, and very annoying by its ceaseless nocturnal clamour. Its flesh is a wholesome and agreeable food (a). The female exudes her ova in bundles in the marshes, &c.

R. temporaria, L.; Rœsel. Ran. pl. i, ii, iii. (The Common Frog). Reddish-brown spotted with black; a black band commencing at the eye and reaching across the ear. This species is the first that appears in the spring; it visits the land less frequently than the preceding, and is not so noisy. Its Tadpole is not so large at the epoch of its metamorphosis. The South of France produces a Frog,

 (a) At least for the French; but these reptiles are never used for food in England.—ENG. ED.

R. cultripes, Cuv., which is every where sprinkled with black spots; feet amply palmate; particularly remarkable for a horny and trenchant scale which invests the vestige of the sixth toe.

Among the Frogs foreign to Europe we may remark,

R. paradoxa, L.; Seb. I, lxxviii; Merrian, Surin. LXXI; Daud., Gren. XXII, XXIII, (The Jakie), whose Tadpole acquires a size previous to its complete metamorphosis greater than that of any other species of the genus. The loss of an enormous tail and of the envelopes of the body causes the adult animal to be of smaller dimensions than the Tadpole, a circumstance which induced the earlier observers to believe that it was the Frog which was metamorphosed into a Tadpole, or, as they expressed it, into a Fish. This error is now completely refuted.

The Jakie is greenish, spotted with brown, and is particularly distinguished by irregular brown lines along its thighs and legs. From Guiana.

There are several other Frogs foreign to Europe, some of which are very large and very ill-determined*. Such is

R. pipiens, L.; Catesb. II, lxxii. (The Bull-Frog). Green above, yellowish beneath, spotted and marbled with black†.

The hind toes of certain species are almost without a web, but still very elongated‡.

CERATOPHRIS, Boié,

Are frogs with a large head; skin granulated, either wholly or in part; a membranous prominence to each eye-lid resembling a horn§. In some

* A closer examination and a review of the numerous Batrachians received at the Museum within a few years, compel me to recal my approbation of the work of Daudin. It is imperfect, and half the figures are taken from altered specimens, and can never serve as guides to the precise determination of species. His *Hyla*, however, must be excepted; they are much better than his Frogs and Toads.

† I am convinced that several species are confounded under this name in the United States, species which are similar as to size and colour, but which, among other characters, differ in the relative size of the tympanum. The one in which it is the largest is the *mugiens* of Merrem, but we cannot depend upon his synonyms. The fig. of Daud. XVIII, with a yellow stripe along the back, is a species from India. Add, *R. palmipes*, Spix, V, 1;—*R. tigrina*, Daud. XX;—*R. virginica*, Gmel. Seb. I, lxxv, 4, or *halecina*, Daud., or *pipiens*, Merr., Catesb. LXX (a).

‡ *Rana ocellata*, L., Seb. I, lxxv, 1, Lacep. I, xxxviii, Daud. XIX;—*R. gigas*, Spix, I;—*R. pachypus*, Id. II.;—*R. coriacea*, Id. V, 2;—*R. sibilatrix*, Pr. Max.;—*R. maculata*, Daud. XVII, 2;—*R. rubella*, Ib. I;—*R. typhonia*, Ib. 4, which is not, as Merrem thinks, the *virginica*, Gm.;—*R. punctata*, Ib. XVI, 1;—*R. mystacea*, Spix, III, 2—3;—*R. militaris* and *R. pygmaea*, Id. VI;—*R. labyrinthica*, Id. VII (b).

§ *Ceratophris varius*, B., or *Rana cornuta*, Seb. I, lxxii, 1, 2;—Tiles., Mag. de Berl. 1809, 2nd Trim. pl. iii, and Krusenst. Voy. pl. vi, or *Ceratophris dorsata*, Pr. Max. 2me livr.;—*Cerat. Spixii*, Cuv., or *R. megastoma*, Spix, IV, 1;—*R. scutata*, Ib. 2;—*Cerat. Daudini*, Cuv., Daud. xxxviii;—*Cerat. clypeata*, Cuv.

¶ (a) *R. clamitans*, Daud. XVI, is also cited as a species, but it is the young of *R. pipiens*.—ENG. ED.

¶ (b) In the annals of the Lyceum, America, the following species are enumerated:—*R. fontanalis*, L. C.;—*R. palustris*, Id.;—*R. sylvatica*, Id.;—*R. pumila*, Id.;—*R. gryllus*, Id.;—*R. nigrita*, Id.: Ann. of the Lyceum. —ENG. ED.

the tympanum is concealed under the skin*. They are all from South America.

Southern Africa produces Batrachians resembling Frogs in their teeth and smooth skin; their toes are pointed, the hind ones broadly palmated, and the extremities of the three internal ones enveloped in a black, conical, horny nail; their head is small and their mouth moderate; the tongue, attached to the lower part of the gullet, is oblong, fleshy, and very large; their tympanum is not visible. These numerous characters have induced us to form a genus for them by the name of *DACTYLETHRA* †.

HYLA, Laur.—CALAMITA, Schn. and Merr.

Tree-Frogs only differ from the true Frogs in the extremities of their toes, each of which is expanded into a rounded viscous pellet, that enables them to adhere to the surface of bodies and to climb trees, where in fact they remain all the summer living upon insects. They spawn, however, in water, and enter the mud in winter like other Frogs. There is a pouch under the throat of the male, which dilates whenever he cries.

Rana arborea, L.; Roes. Ran. pl. ix, x, xi. (The Common Tree-Frog). Green above, pale beneath; a black and yellow line along each side of the body. They are adult in four years, and couple towards the end of April. The Tadpole completes its metamorphosis in the month of August.

The *Hylæ* foreign to Europe are numerous, and some of them beautiful. One of the largest and handsomest is

H. bicolor, Daud. VIII; and Spix, XIII. Sky-blue above, rose colour beneath. From South America. A still larger species,

H. palmata, Daud. XX; *Rana maxima*, L., is transversely and irregularly striped with red and fawn-colour. From North America ‡.

On account of the singular property attributed to it we may mention the

Rana tinctoria, L. (The Stained Tree Frog). It is said, that, if some of the feathers of a Parrot be plucked out and the skin be imbued with the blood of this animal, it causes a reproduction of red or yellow feathers, and forms that peculiar appearance which is termed

* *Ceratophris granosa*, Cuv., one of those Frogs with a concealed tympanum, of which Gravenhorst has made his genus *STOMBUS*; but they have teeth like the others, and should not be approximated to the Toads, where Fitzinger has placed them.

† From the Greek word *daktylethra* (thimble): such is the form of their nails. The *Crapaud lisse*, Daud. pl. xxx, f. 1, is a bad figure, the hind feet being altogether wrong; it forms the *Pipa lævis*, Merr. The *Pipa bufonia*, Merr., or pretended male *Pipa*, Enl. No. 21, f. 2, is also the same species, but drawn without nails. These species of Merrem constitute the *ENGYSTOMA* of Fitzinger, but the true *Engystomæ* or the *Breviceps*, Merr., have neither teeth nor nails.

‡ Add, of palmated species, *Hyl. venulosa*, Daud. XIX, or *Cal. boans*, Merr., Seb. 1, lxxii;—*H. tibicen*, Seb. Ib. 1, 2, 3;—*H. marmorata*, Seb. I, lxxi, 4, 5; Daud. XVIII;—*H. lateralis*, Catesb. II, lxxi, Daud. II;—*H. bilineata*, Daud. III;—*H. verrucosa*;—*H. oculata*;—*H. frontalis*, Id., and in Spix; *Hyl. bufonia*, XII;—*H. geografica*, XI, 1;—*H. albomarginata*, VIII, 2;—*H. papillaris*, 2;—*H. pardalis*, 3;—*H. cinerascens*, 4;—*H. affinis*, VII, 3.

by the French *tapire* (a). We are assured it is a brown species, with two whitish bands transversely united in two places (Daud. pl. viii); the toes of the hind feet are almost free*.

BUFO, Laur.

Toads have a bulky body covered with warts or papillæ; a thick lump behind the ears pierced with pores, from which issues a milky and fetid humour; no teeth whatever; the hind feet but slightly elongated. They leap badly, and generally avoid the water. They are hideous and disgusting animals, whose bite, saliva, urine, and even perspiration, are considered, though erroneously, as poisonous.

Rana bufo, L.; Rœs. Ran. XX. (The Common Toad). Reddish-grey, or grey brown; sometimes olive or blackish; the back covered with rounded tubercles as large as lentils; smaller and more closely set tubercles on the belly; the hind feet semi-palmate. It remains in dark places, and passes the winter in a hole which it excavates. It couples in the water in March and April; when this takes place on shore, the female drags herself to some ditch, &c., carrying the male with her: she produces innumerable small ova, united by a transparent kind of jelly in two strings, that are often twenty or thirty feet long, in the extraction of which the male assists with his hind feet. The Tadpole is blackish, and is the smallest of the European species, at the period when it acquires legs and loses its tail. The Common Toad lives upwards of fifteen years, and has young at four. Its cry has some resemblance to the barking of a dog.

R. bufo calamita, Gm.; Rœs. XXIV; Daud. XXVII, 1. (The Bush Frog). Olive-colour; tubercles, as in the preceding; but not such large swellings behind the ears; a yellow longitudinal line on the spine, and a dentated reddish one on the flank: no membrane to the hind feet. It diffuses a disagreeable odour, like that of gunpowder, lives on land, and never leaps, but runs tolerably fast; climbs up walls, to seek a shelter in their crevices, and for that purpose has two little osseous tubercles under the palm of the hands. It never visits the water except to couple, in the month of June; the female lays two strings of eggs, like the Common Toad; the voice of the male, which has also a sac under the throat, resembles that of the Stained Tree Frog.

Bufo fuscus, Laurent.; *Rana bombina*, g, Gm.; Rœs. XVII, XVIII. (The Natter-Jack). Light brown, marbled with dark

* Add, of species whose hind toes are but slightly palmate, *H. femoralis*, Daud. IV;—*H. squirella*, Daud. V;—*H. trivittata*, &c., Spix, IX;—*H. abbreviata*, Id. XI, 4;—*H. delitescens*, L. C., and *H. versicolor*, Id. loc. cit.

The *Hyla cyanea*, Daud., of New Holland, according to White, p. 248, has but four toes behind; and M. Fitzinger, who appears to have seen it, has consequently formed it into his genus CALAMITA. We have one from the same country, and exactly similar, which certainly has five.

brown or blackish; tubercles on the back but few, and the size of lentils; the belly smooth; toes of the hind feet elongated, and completely palmate; it leaps well, prefers the vicinity of water, and diffuses a strong odour of garlic when disturbed. The ova form but one string, thicker however than both those of the Common Toad. The Tadpole is longer in coming to maturity than any other French species; and, when very large, is still found with its tail, and the fore-feet, not developed—when it does complete its metamorphosis, it actually seems to shrink. It is eaten in some places as if it were a fish.

Ran. variabilis, Gm.; *Crapaud vert*, Lacep.; Pall. Spicil. VII, vi, 34; Daud. xxviii, 2. (The Variable Frog). Almost smooth; whitish, with deep green spots; remarkable for the changes in the hue of the skin, according to the light in which it is placed, or as it wakes or sleeps.

Bufo obstetricans, Laur.; *Le Crap. accoucheur*, Daud. pl. xxxii, f. 1. (The Midwife Frog). Small; grey above; whitish beneath; blackish points on the back, and whitish ones on the sides. The male assists his female in the expulsion of the eggs, which are large, and fastens them on his thighs, in bundles, by means of some glutinous threads. He carries them about with him until the eyes of the Tadpoles they contain can be distinguished through their envelope, and, in fact, until the time when they are about to be hatched; he then seeks some stagnant water, in which he deposits them. The eggs immediately split, and the Tadpoles swim out. It is very small, and is carnivorous. Very common in stony places near Paris*.

Sicily produces a Toad three or four times larger than those of France, that is brown, with flat and irregular tubercles. It is generally found in the tuft of a palm. We will call it *Bufo palmarum*—the Palm Frog.

The Toads, foreign to Europe, have hitherto been badly determined; several are remarkable for their size.

Rana marina, Gm.; *Le Crapaud aqua*; Daud. XXVII; Spix, XV. Brown, varied with dark brown; unequal and slightly salient tubercles; the triangular parotids more than an inch wide in individuals, which are from ten to twelve inches long, exclusive of the feet. Found in the marshy districts of South America†.

Several subgenera have been lately separated from that of the Toads; thus, the

* It is impossible to say why Merrem placed the *obstetricans* among his Bombinatores—its tympanum is very visible.

† Add, *Bufo maculiventris*, Spix, XV, should it prove to differ from the *agua*;—*B. ictericus*, Id. XVI, 1;—*B. lazarus*, Id. xvii, 1;—*B. stellatus*, Id. XVIII, 1;—*B. scaber*, Daud. XXXIV, which is not the same as the *B. scaber* of Spix, X, 1;—*B. bengalensis*, Id. xxxv, 1;—*B. musicus*, Id. XXXIII, 2;—*B. cinctus*, Pr.⁶Max. fasc. 3; the *B. aqua*, Id. fasc. 7, does not appear to be the same as that of Spix.

BOMBINATOR, *Merr.*,

Only differs from the others in the tympanum being concealed under the skin; such in France is the

Rana bombina, Gm.; *Crapaud à ventre jaune*; Rœs. XXII; Daud. XXVI. The smallest and most aquatic of all the Toads of that country. It is greyish or brown above; a black-blue with orange spots beneath; the hind feet completely palmate and almost as long as those of Frogs, so that it leaps nearly as well. It lives in marshes, and couples in June; the eggs are produced in little balls, and are larger than those of the preceding species*. The

RHINELLUS, *Fitzing.*—OXYRYNCHUS, *Spix*,

Has a muzzle pointed anteriorly†. We should approximate to it the

OTILOPHIS, *Cuv.*

In which the muzzle is also angular, and where there is a crest on each side of the head which extends over the parotid. The *Crapaud perlé*, (*Ran. margaritifera*, Gm.) Daud. XXXIII, is its type.

BREVICEPS, *Merr.*—ENGYSTOMA, *Fitzing. part of.*

Toads without a visible tympanum or parotid, in which the body is oval, head and mouth very small, and the feet but slightly palmated‡.

A more essential difference is that which has separated the *Pipæ* of Laurenti from all the great genus *Rana*.

PIPA, *Laur.*

This subdivision is distinguished by a horizontally flattened body; a broad and triangular head; by the absence of a tongue; by a tympanum concealed under the skin; by small eyes placed near the edge of the upper jaw; by anterior toes, each of which is divided at the extremity into four small points; and, finally, by the enormous larynx of the male, formed like a triangular osseous box, inside of which are two moveable bones, which can be made to close the entrance to the branchiæ§.

* Add, *Bufo ventricosus*, Daud. XXX, 2, the turgidity of which is exaggerated.

† *Bufo proboscideus*, Spix, XXI, 4;—the neighbouring species figured on the same plate, *B. semilineatus*, *B. granulosus*, *B. aculirostris*, and those of pl. xiv, *narius* and *nasutus*, connect this subgenus too closely with the common Toads to be easily retained.

‡ *Engystoma dorsatum*, Cuv., or *Bufo gibbosus*, Auct. Seb. II, xxxvii, No. 3, Daud. XXIX, 2;—*Eng. marmoratum*; *Eng. granosum*, Cuv.; new species, one from India, the other from the Cape. The mouth of the *Eng. surinamense*, Daud. XXXIII, 2, is already larger, as well as in the *B. globulosus* and *albifrons*, Spix, XIX. N.B. The *Eng. ovalis*, Fitz., is a *Dactylethra*; his *Eng. ventricosa*, Daud. XXX, 2, is a *Bombinator*.

N.B. The *Bufo ephippium*, Spix, XX, 2, of which Fitzinger makes his genus *BRACHYCEPHALUS*, on account of there being but three toes to all the feet, may be a young specimen badly preserved or incorrectly figured.

§ Described by Schneider under the name of *Cista sternalis*.

The species formerly known, *Rana pipa*, L.; Seb. I, lxxvii; Daud. xxxi, xxxii, is found at Cayenne and Surinam, in dark places about the houses. Its back is granulated, with three longitudinal ranges of larger granules. When the ova are expelled, the male places them on the back of the female, and there fecundates them; the latter then proceeds to the water, the skin of her back swells and forms cells, in which the eggs are hatched. The life of the Tadpole is passed in the water, and it does not leave it until it has lost its tail, and acquired feet. It is at this time also that the mother returns to land.

Spix figures one of them pl. xxii, at least a closely allied species,—*Pipa curururu*, Spix,—from the bottom of the Brazilian lakes, and asserts that the female does not carry her young; he does not inform us, however, that he observed her during the whole year*.

SALAMANDRA, *Brongn.*

The Salamanders have an elongated body, four feet and a long tail, which give them the general form of Lizards, so that Linnæus left them in that genus: but they have all the characters of Batrachians.

Their head is flattened; the ear completely hidden under the muscles, without any tympanum, having nothing but a small cartilaginous plate on the fenestra ovalis; the two jaws furnished with numerous and small teeth; two longitudinal rows of similar teeth in the palate, but attached to bones analogous to the vomer; the tongue as in the Frogs; no third eye-lid; a skeleton with very small rudiments of ribs, but without a bony sternum; a pelvis suspended from the spine by ligaments; four toes before, and almost always five behind. In their adult state, respiration is performed as in Frogs and Tortoises. Their Tadpoles at first breathe by means of branchiæ resembling tufts, three on each side of the neck, which are subsequently obliterated; they are suspended to cartilaginous arches, vestiges of which remain in the hyoid bone of the adult. A membranous operculum covers these openings, but the tufts are never enclosed by a tunic, and always float externally. The fore feet are developed before the hind ones; and the toes in both feet appear successively.

SALAMANDRA, *Laur.*

The Terrestrial Salamanders have in their perfect state the round tail; they inhabit the water only during their tadpole condition, which is but a short period, or when the female is ready to bring forth. The eggs are hatched in the oviduct.

The terrestrial species of France have a gland analogous to that of the Toad, on each side of the occiput.

Salam. maculosa, Laur.; Lac. II, pl. xxx; *Lacert. salamandra*, L. (The common Salamander.) Black, with large spots of a bright yellow; rows of tubercles on the sides, from which, when the animal

* There is a true *Pipa* in the King's Cabinet, from Rio Negro, which is entirely smooth, and with an unusually narrow head. It will be my *Pipa levis*, very different from that of Merrem, which is a *Dactylethra*.

is agitated by fear, oozes a milky, bitter liquid, that has a strong odour, and is poisonous to very weak animals. It is, perhaps, this circumstance which has given rise to the fable of the incombustibility of the Salamander. It lives in wet places and hides itself in holes, feeds on lumbrici, insects and earth, brings forth its young living, and deposits them in pools; at first they have branchiæ, and their tail is vertically compressed*.

A Salamander resembling the common one, but entirely black and entirely without spots, is found in the Alps, it is the *Sal. atra* (the black Salamander), Laurent. pl. 1, f. 2.

Sal. perspicillata, Savi. (The spectacled Salamander). Only four toes to all the feet; black above; yellow, spotted with black beneath: a yellow line across the eyes. A small species from the Appennines†.

North America, which produces many more Salamanders than Europe, has several that are terrestrial, with a round tail, but deficient in the glands on the occiput‡.

TRITON, *Laurenti*.

The aquatic Salamanders always retain the vertically compressed tail, and pass nearly the whole of their existence in the water. The experiments of Spallanzani on their astonishing power of reproduction, have rendered them celebrated. If a limb be amputated, another is reproduced in its stead with all its bones, muscles, vessels, &c. and this takes place several times in succession. Another not less singular faculty, discovered by Dufay, is the power they possess of remaining enclosed in ice for a considerable time without perishing.

Their eggs are fecundated by the seminal fluid diffused in the water, and both enter the oviduct together; they are expelled in long chaplets; the young are not hatched until the fifteenth day, and retain their branchiæ for a longer or shorter time according to the species. Modern observers have recognized several of them in France, but as the colour of these animals changes according to the age, sex, and season of the year, and as the crests and other ornaments of the males are only well developed in the spring, the species have not been determined with certainty. When winter surprises them with their branchiæ, they retain them till the following year, always increasing in size§.

* See Ad. Fred. Funck. *de Salam. terrest. vita, evolutione, formatione*, Berlin, fol. 1827.

† We have ascertained that the *Sal. à trois doigts*, Lacép. II, pl. 36, is merely a dried and somewhat mutilated specimen of the *Sal. perspicillata*. Add, *S. Savi*, Gosse.

‡ *Sal. venenosa*, Daud., or *subviolacea*, Barton;—*Sal. fasciata*, Green;—*Sal. tigrina*, Id.;—*Sal. erythronota*, Id.;—*Sal. bilineata*, Id.;—*Sal. rubra*, Daud. VIII, pl. 91, f. 2;—*S. variolata*, Gilliam. Sc. Nat. Phil., 1, pl. xviii, f. 1, and several new species. The *Sal. japonica*, Hourtuin, Bechst. trans. of Lacép., II, pl. 18, f. 1, is closely allied to the *erythronota*.

§ It was from an individual which had thus retained its branchiæ that Laurenti made his *Proteus tritonius*.

S. marmorata, Latr.; *Triton Gesneri*, Laur. (The Marbled Salamander). Skin granulated; pale green above, with large irregular brown spots; brown, dotted with white, beneath; a red line along the back, which, in the male, is slightly crested and marked with black spots. But slightly aquatic.

S. alpestris; *Salam. à flancs tachetés*, Bechst. tr. Lac. pl. xx. (The Flank Spotted Salamander). Skin granulated; slate coloured and brown above; orange or red belly; a band of numerous small black spots on each flank.

S. cristata, Latr. (The Crested Salamander). Skin granulated; brown above, with round blackish spots; orange beneath, similarly spotted; sides dotted with white; crest of the male elevated, acutely denticulate, and in the nuptial season edged with violet.

S. punctata, Latr. (The Pointed Salamander). Skin smooth; a light brown above; pale or red beneath; round black spots every where; black streaks on the head; crest of the male festooned; the toes somewhat widened, but not palmate.

S. palmata, Latr. (The Web-footed Salamander). Back, brown; top of the head vermiculated with brown and blackish; paler on the flanks, with round blackish spots; belly without spots. The male has three small dorsal crests; toes dilated and united by membranes, and the tail terminated by a small filament*.

Several aquatic Salamanders are also found in North America†.

Skeletons of a Salamander three feet in length have been discovered among the schist of Oeningen. One of them is the pretended *Fossil Man* of Scheuchzer.

Immediately after the Salamanders come several very similar animals, some of which are considered as never having had branchiæ, that is, they probably lose them at as early a period as our terrestrial Salamanders; the others, on the contrary, retain them for life, a circumstance which by no means prevents their having lungs like the Batrachians, so that they may be considered as the only vertebrate animals which are truly amphibious‡.

* The characters of the European species appear to me to be such as are most conformable to nature; to add the synonymes of authors would be a difficult task, so little do their figures and descriptions agree with the animals before me.

† *Sal. symmetrica*, Harl. which appears to me previously represented in Bechstein's Lacép. II. pl. xviii, f. 2, under the name of *Sal. punctata*, and several species whose descriptions I could not recognize, and which richly merit a monograph, accompanied by good figures.

‡ The simultaneous existence and action of the branchial tufts and of the lungs in these animals, are as incontestable as any one of the most certain facts in natural history; there are now before me the lungs of a Siren three feet long, in which the vascular apparatus is as well developed and as complex as in any reptile whatever, notwithstanding which, the branchiæ of this same animal were as complete as those of others.

The former (those in which no branchiæ are visible) constitute two genera.

MENOPOMA, *Harlan**.

Form of a Salamander; eyes apparent, the feet well developed, and an orifice on each side of the neck. Besides the range of small maxillary teeth, there is a parallel row of them on the front of the palate. Such is the reptile termed

Sal. gigantea, Barton; *Great Salamander of North America*; Ann. of the New York Lyc. I, pl. 17. (The Hellbender of the United States). From fifteen to eighteen inches long; a blackish blue; inhabits the great lakes and the rivers of the interior.

AMPHIUMA, *Garden*.

Have an orifice on each side of the neck, but their body excessively elongated; the legs and feet, on the contrary, but very slightly developed; the palatine teeth form two longitudinal ranges.

In one species there are but three toes to each foot; *Amph. tridactylum*, Cuv.; and in another, *Amph. means*, Gard. and Harl. but two—Mem. du Mus. XIV, pl. 1†.

Among those which always retain their branchiæ, the

AXOLOTUS.

The Axolots in every respect are similar to the larvæ of an aquatic Salamander, having four toes before, five behind, three long tufted branchiæ, &c. The maxillary teeth are like velvet, and those on the vomer in two bands. Such is the

Siren pisciformis, Shaw; the *Axolotl* of the Mexicans; Gen. Zool. vol. III., part ii. pl. 140; Humb. Zool. Obs. I, pl. 12. From eight to ten inches long; grey, spotted with black. It inhabits the lake that surrounds Mexico‡.

MENOBANCHUS, *Harlan*.—NECTURUS, *Raffin*.

Have but four toes to all the feet; a range of teeth in the intermaxillaries, and another, parallel, but more extended, in the maxillaries.

* Dr. Harlan first called them ABRANCHUS; Leukard and Fitzinger called them CRYPTOBANCHUS, and others PROTONOPSIS.

† The *Amphiuma* was known to Linnæus, but at too late a period to allow him to insert it in any of the editions of his system which appeared during his life. It has been described since by Dr. Mitchell, under the name of *Chrysodonta larvæformis*, and by Dr. Harlan under that of *Amphiuma*. I have described the *Amph. tridactylum* of Louisiana, which attains the length of three feet. See Mém. du Mus. tome XIV, 1. I suspect this is the species spoken of by Barton in his letter upon the Siren, as a Siren with four feet.

‡ It is with some hesitation that I place the Axolotl among the genera with permanent branchiæ, but so many witnesses assure us that it does not lose them that I am compelled to do so.

The species most known, *Menobrachius lateralis*, Harl.; *Triton lateralis*, Say; Ann. of the New York Lyc. I, pl. xvi, inhabits the great lakes of North America, attaining, as it is said, the length of two and three feet. It was first obtained from Lake Champlain.

PROTEUS, *Laurent.*—HYPOCHTON, *Merr.*

But three toes before and only two behind.

Hitherto but a single species has been discovered, *Proteus anguinus*, Laur. pl. IV. f. 3; Daud. VIII. xcix. 1; *Siren anguina*, Schn. More than a foot long, about the thickness of a finger, with a vertically compressed tail and four small legs. Its muzzle is elongated and depressed; its two jaws furnished with teeth; its tongue but slightly moveable and free before; its eyes extremely small and hidden by the skin, like those of the Zemni (*Mus typhus*, Pall.); the ear covered by the muscles as in the Salamanders, and the skin smooth and whitish. It is only found in some subterraneous streams, by which certain lakes in Carniola communicate with each other. The skeleton resembles that of the Salamander, except that it has many more vertebræ, and fewer rudiments of ribs; the bony head, however, differs altogether in its general conformation.

Finally, there are some which are possessed of fore feet only, the hind ones being entirely deficient. They are

SIREN, *Linn.*

The Sirens are elongated animals, almost of the form of eels, with three branchial tufts; they have no hind feet, nor is there even a vestige of a pelvis. Their head is depressed, the opening of their mouth small, their muzzle obtuse, eye very small and ear concealed; the lower jaw is armed with teeth all round, and there are none in the upper one, but there are several rows of them adhering to two plates fixed under each side of the palate*.

S. lacertina, L. (The Lizard Siren). Blackish, and attains the length of three feet; four toes to each foot; tail compressed into an obtuse fin. It inhabits the marshes of Carolina, the rice swamps particularly, where it lives in the mud, occasionally going on shore or into the water. It feeds on lumbrici, insects, &c.†. There are two much smaller species,

S. intermedia, Le Conte, Ann. New York Lyc., II. Dec. 1826,

* It is in vain that some authors have recently endeavoured to revive the antient idea, that the Siren is the *tadpole* of the Salamander. We possess specimens of them much larger than any known Salamander, whose bones have acquired their perfect hardness without the smallest vestige of hind feet; their osteology also differs widely from that of the Salamanders; they have more and differently shaped vertebræ (90), and fewer ribs (eight pairs); the conformation of the head, and the connexion of the bones which compose it, are altogether different. See Oss. foss. tome v. part ii.

† Barton denies that it feeds on serpents, and that its voice resembles that of a young duck, as affirmed by Garden. Barton, "Some account of *S. Lacert.* &c."

pl. 1. Blackish; four toes like the large one, but the branchial tufts are less fringed; its length does not exceed one foot.

S. striata, Le Conte, Ib. I, pl. 4. Blackish; two longitudinal yellow streaks on each side; only three toes; the branchial tufts but slightly fringed; length nine inches*.

* The branchiæ of these two species have been considered as taking no part in the process of respiration, in consequence of which M. Gray has formed a genus for them, which he calls PSEUDOBANCHUS; it is easy, however, on their inferior surface, to see folds and a vascular apparatus, whose use is, to us, very plain; besides this, the observations of Major Le Conte demonstrate the fact, that these sirens, like the lizard sirens, are perfect animals.

CLASS IV.—OF VERTEBRATA.

FISHES.

THE class of Fishes is composed of oviparous vertebrata with a double circulation, but in which respiration is altogether effected through the medium of water. For this purpose, on each side of the neck, they have an apparatus called branchiæ, which consist of laminæ suspended on arches that are attached to the hyoid bone, each composed of numerous laminæ placed in a row, and covered with a tissue of innumerable blood-vessels. The water which the fish swallows, penetrates between these laminæ, through the openings, called gills, and, by means of the air it contains, acts upon the blood that is continually sent to the branchiæ from the heart, which only represents the right auricle and ventricle of warm-blooded animals.

This blood, having undergone respiration, is poured into an arterial trunk situated under the spine, which, exercising the functions of a left ventricle, distributes it to every part of the body, whence it returns to the heart by the veins.

The entire structure of the Fish is as evidently adapted for swimming as that of the Bird for flight. Suspended in a liquid of nearly the same specific gravity as its own body, there was no necessity for large wings to support it. In a great number of species, immediately under the spine, there is a bladder filled with air, which, by compression or dilatation, varies the specific gravity of the fish, and assists it to rise or descend. Progression is effected by the motions of the tail, which, by striking the water alternately right and left, forces them forward; the branchiæ, by impelling the water backwards, may also contribute to this effect. The limbs being thus of but little use, are greatly reduced; the parts analogous to the bones of the arms and legs are extremely short, or even completely concealed; *rays*, more or less numerous, which support membranous fins, form a rude representation of the fingers and toes. The fins which correspond to the anterior extremities are termed *pectoral*, and those which answer to the posterior ones, *ventral*. Other rays attached to particular bones placed on or between the extremities of the spinous apophyses support vertical fins on the back, under the tail, and at its extremity, which, by being raised or lowered, increase or diminish the surface that strikes against the water. The superior fins are called *dorsal*,

the inferior *anal*, and the fin at the end of the tail *caudal*. The rays are of two kinds; the one consists of a single bony piece, usually hard and pointed, sometimes flexible and elastic, divided longitudinally—these are called *spinous rays*; the others are composed of a great number of small articulations, and are generally divided into branches at their extremity—they are the *soft, articulated, or branched rays*.

There is as much variety among Fishes, with respect to the number of limbs, as among Reptiles. Most generally there are four; some have but two, and in others they are totally wanting. The bone which is analogous to the scapula, is sometimes held among the muscles as in the higher animals, and at another time it is attached to the spine, but most commonly it is suspended on the cranium. The pelvis rarely adheres to the spine, and very frequently, instead of being behind the abdomen, is before it, and connected with the humeral apparatus.

The vertebræ of Fishes are united by concave surfaces filled with cartilage, which most generally communicate by a canal excavated in the axis of the vertebræ. In most of them there are long spinous processes which maintain the vertical form of the body. The ribs are frequently soldered to the transverse processes.

The head of Fishes varies more as to form than that of any other class, notwithstanding which it almost always consists of the same number of bones as is found in other oviparous animals. The frontal bone is composed of six pieces; the parietal of three; the occipital of five; five pieces of the sphenoid, and two of each temporal bone, remain in the composition of the cranium.

Besides the usual parts of the brain which are arranged as in reptiles in a row, fishes have also knots or ganglions at the base of their olfactory nerves.

Their nostrils are simple cavities at the end of the muzzle, almost always perforated by two holes, and regularly lined by a plaited pituitary membrane.

The cornea of their eye is very flat, and there is but little of the aqueous humour; the chrySTALLINE lens, however, is very hard, and almost globular.

Their ear consists of a sac representing the vestibule, in which are suspended small bodies most commonly of a stony hardness, and of three membranous semi-circular canals, situated in the cavity of the cranium rather than in the substance of its parietes, the Chondropterygii excepted, in which they are entirely contained in them. The eustachian tube and tympanal bones are always deficient, and the Selachians alone have a *fenestra ovalis*, which is level with the head.

The sense of taste in fishes can have but little energy, as a great por-

tion of the tongue is osseous, and frequently furnished with teeth and other hard parts.

The body in most of them is covered with scales, and none possess organs of prehension; the fleshy cirri of some may supply the imperfection of the other organs of touch.

In the greater number, the intermaxillary bone forms the edge of the upper jaw, having behind it the maxillary, termed the labial bone (*mystace*). A palatine arch, composed of the palatine bones, of the two pterygoid processes, the zygomatic process, the tympanum and squamous portion, forms, as in Birds and Serpents, a sort of interior jaw, and furnishes behind an articulation for the lower jaw, which generally has two bones on each side; the number of these pieces, however, is reduced in the Chondropterygii.

Teeth are found in their intermaxillary, maxillary, and lower jaws, in the vomer, the bones of the palate, on the tongue, on the arches of the branchiæ, and even on the bones situated behind these arches, attached like them to the hyoides, and called pharyngeal bones.

The varieties of these combinations, as well as those of the form of the teeth placed at each point, are innumerable.

Besides the apparatus of the branchial arches, the hyoid bone is furnished on each side with rays which support the branchial membrane. A sort of lid, composed of three bony pieces, the operculum, the suboperculum, and the interoperculum, unites with this membrane in closing the great opening of the gills; it is articulated with the tympanal bone, and plays on one called the preoperculum. In many of the Chondropterygii this apparatus is wanting.

The stomach and intestines differ in size, figure, thickness, and convolutions, as greatly as in the other classes. The pancreas, except in the Chondropterygii, is replaced either by cæca of a peculiar tissue situated round the pylorus, or by the tissue itself applied to the origin of the intestine.

The kidneys are situated along the sides of the spine, but the bladder is above the rectum, and opens behind the anus and behind the orifice of generation; exactly the inverse of what we find in the Mammalia.


The testes are two enormous glands commonly termed *milts*; and the ovaries, or roe, two sacs about the same form and size, in whose internal folds are deposited the eggs. Some of the ordinary fishes copulate and are viviparous; the young fry are hatched in the ovary and issue through a very short canal. The Selachians alone, besides the ovary, have long oviducts which frequently open into a true uterus, and they produce either living ones or eggs enveloped with a horny substance. In most Fishes, however, copulation does not take place; when the female has laid, the male

passes over the egg, diffusing the secretion from the milts, and fecundating the eggs (a).

Of all the classes of animals, that of fishes is the most difficult to subdivide into orders from fixed and sensible characters. After many attempts I have decided upon adopting the following arrangement, which, though it militates in some instances against precision, does not separate natural families.

Fishes form two distinct series, that of FISHES, *properly so called*, and that of the CHONDROPTERYGII, otherwise called CARTILAGINOUS FISHES.

The general character of the latter consists in the absence of the bones

 (a) In the great work on Icthyology, by Cuvier, now in the course of publication, he dwells at much greater length on the general characters of the Fishes. The following passage, which we translate from that work, will be read with much interest:—

“Being aquatic, that is to say, living in a liquid which is heavier, and offers greater resistance than air, their power of motion has been necessarily disposed and calculated for progression as well as for elevation, which is also accomplished by them with ease. Hence arises that form of body which offers least resistance, the chief seat of muscular force residing in the tail, the shortness and expansibility of their limbs, the membranes which support them, the smooth or scaly teguments, and the total absence of hairs or feathers. Breathing only through the medium of water, that is, for the purpose of giving an arterial nature to their blood, profiting by the small quantity of oxygen contained in the air, which is mingled with the water, their blood is necessarily cold, and their vitality, the energy of their senses and movements, are consequently less than in Mammalia and Birds. Their brain, therefore, or rather a composition similar to it, is proportionably much smaller, and the external organs of their senses are not of a nature to admit of powerful impressions. Fishes, in fact, are, of all vertebrated animals, those which have the least apparent signs of sensibility. Having no elastic air at their disposal, they remain mute, or nearly so, and all those sensations awakened or sustained by the voice remain unknown to them. Their eyes almost immovable, their bony and rigid countenance, their limbs deprived of the power of inflexion, and every part moving at the same time, deprive them of the faculty of varying their physiognomy, or expressing their emotions. Their ear, inclosed on every side by the bones of the skull, without external conch or internal labyrinth, and composed only of a sac and membranous canals, scarcely allows them to distinguish the most striking sounds; and, in fact, an exquisite sense of hearing would be of very little use to those destined to live in the empire of silence, and around whom all are mute. Their sight, in the depths of their abode, would be little exercised, if the greater number of the species had not, by the size of their eyes, been enabled to supply the deficiency of light; but, even in these species, the eye scarcely changes its direction; still less can it change its dimensions, and accommodate itself to the distance of objects; its iris neither dilates nor contracts, and its pupil remains the same in every degree of light. No tear bathes this eye, no eyelid soothes or protects it; and, in this class, it must be regarded as only a feeble representation of that beautiful, brilliant, and animated organ of the higher classes of animals. Procuring food by swimming after a prey which itself swims with greater or less rapidity, having no means of seizing this prey but by swallowing it, a delicate sense of taste would have been useless to fishes had nature bestowed it on them. But their tongue, almost immovable, often bony, or armed with dentated plates, and only receiving a few slender nerves, demonstrates that this organ is as little sensible as it is little necessary. Smell even cannot be as continually exercised by fishes as by animals which breathe air in a direct manner, and whose nostrils are unceasingly traversed by odoriferous vapours. Lastly, we come to the touch, which, on account of the surface of their bodies being encircled by scales, by the inflexibility of the rays of their limbs, and by the dryness of the membranes enveloping them, has been obliged as it were to seek refuge at the end of their lips; and even these, in some species, are reduced to a dry and insensible hardness.”—ENG. ED.

of the upper jaw, whose place is supplied by those of the palate: their whole structure also exhibits evident analogies which we will describe: it is divided into three orders.

The *CYCLOSTOMI*, whose jaws are soldered in an immoveable ring, with branchiæ containing numerous openings.

The *SELACHII*, which have the branchiæ of the *Cyclostomi*, but not their jaws.

The *STURIONES*, whose branchiæ are opened by the usual fissure furnished with an operculum.

The other series, or that of the *ORDINARY FISHES*, presents a primary division in those where the maxillary bone and the palatine arch are fixed to the cranium: they constitute an order which I call that of the *PLECROGNATHI*, and are divided into two families: the *GYMNODONTES* and the *SCLERODERMI*.

I next find fishes with perfect jaws, but whose branchiæ, instead of being pectiniform, as is the case in all the others, resemble a series of small tufts; they also constitute an order which I call *LOPHOBRANCHII*, that comprises but a single family.

There then remains an immense number of fishes, to which no other characters can be applied than those of the external organs of motion. After an extensive research, I have found that the least objectionable of these characters is the one employed by Ray and Artedi, drawn from the nature of the first rays of the dorsal and anal fins. Thus the ordinary fishes are divided into *MALACOPTERYGII*, in which all the rays are soft, with the occasional exception of the first of the dorsal or of the pectorals; and into *ACANTHOPTERYGII*, in which the first portion of the dorsal, or of the first dorsal where there are two, is always supported by spinous rays, and in which some of the same are always found in the anal fin, and at least one in each of the ventral ones.

The first may be conveniently divided by a reference to the position of their ventral fins, which are sometimes situated behind the abdomen, sometimes suspended to the apparatus of the shoulder, or are totally wanting.

We thus arrive at the three orders of the *MALACOPTERYGII ABDOMINALES*, the *SUBBRACHIATI* and the *APODES*, each of which comprises certain natural families to be described. The first is particularly numerous.

It is impossible, however, to apply this mode of division to the *ACANTHOPTERYGII*; and their subdivision in any other way than by that of natural families is a problem that I have hitherto vainly endeavoured to solve. Fortunately, many of these families are possessed of characters nearly as exact as those which could be given to true orders.

It is, besides, impossible to assign to the families of fishes the same marked gradation that is visible among those of the Mammalia. Thus, the Chondropterygians are connected with Serpents on the one hand by the organs of the senses, and some of them even by those of generation; while the imperfection of the skeleton in others allies them to the Mollusca and Worms.

As to the Ordinary Fishes, if any one system is found more developed in some than in others, it is not sufficiently pre-eminent, nor does it exercise a sufficient influence over the whole to compel us to pay any regard to it in a methodical arrangement.

We will successively treat of these two series, commencing with the most numerous, that of Ordinary Fishes, and placing at its head the order richest in genera and species.

ORDER I.

ACANTHOPTERYGIANS.

THE Acanthopterygians form the first and by far the most numerous division of Ordinary Fishes. They are recognized by the spines which occupy the place of the first rays of their dorsal, or which alone support the first fin of the back, where there are two; sometimes, instead of a first dorsal, there are only a few free spines. The first rays of their anal are also spines, and there is generally one to each ventral.

The relations between the Acanthopterygii are so multiplied, and their different natural families present so much variety in the apparent characters which we might suppose would indicate orders or other subdivisions, that it has been found impossible to divide them otherwise than by these same natural families, which we are compelled to leave together.

FAMILY I.

THE PERCH TRIBE.—PERCOIDES*.

This family, thus called because its type is the Common Perch, comprehends fishes with oblong bodies, covered with scales that are gene-

* In my first edition this family also comprehended the *Buccæ Loricatæ*, the *Scienoides*, and the *Sparoides*. It was necessary to detach these three new families

rally hard or rough, and whose operculum or preoperculum, and frequently both, have dentated or spinous edges, and whose jaws, the fore-part of the vomer, and almost always the palatine bones, are furnished with teeth.

The species are extremely numerous, particularly in the seas of hot climates; their flesh is generally wholesome and agreeable.

In a vast proportion of these Perches, the ventral fins are inserted under the pectorals: they form a first division, which may be called *PERCOIDES THORACICI*, or *THORACIC PERCHES*.

They were nearly all comprised by Linnæus in his genus *PERCA*, but we have been compelled to divide them as follows, from the number of the branchial rays, that of the dorsal fin, and the nature of the teeth.

The first subdivision has seven rays in the branchiæ, two fins on the back, and all the teeth small and dense as the pile on velvet.

PERCA, Cuv.

The true Perches have the preoperculum dentated: the bony operculum terminated by two or three sharp points and a smooth tongue. Sometimes the sub-orbital and the humeral are slightly dentated.

P. fluviatilis, L.; Bl. 52. (The Common Perch). Greenish; broad, vertical, blackish bands; ventral and anal fins red; one of the most beautiful and best of the European fresh-water fishes. It inhabits pure and running streams; its eggs are united by a viscid matter into long strings, which form a kind of net-work.

North America produces several neighbouring species*.

LABRAX, Cuv.

The Bars are distinguished from the Perches by scaly opercula terminating in two spines, and by a rough tongue.

L. lupus, Cuv.; *Perca labrax*, L.; *Sc. diacantha*, Bloch, 305; *Bars Commun*; *Spigola* of the Italians; Cuv. and Val. II, xi. (The Basse Perch). A large fish found on the coast of Europe; it is highly flavoured, and of a silvery hue. It is particularly common in the Mediterranean, and is the *Lupus* of the Romans, and the *Labrax* of the Greeks. The young ones are usually spotted with brown.

The United States produce a large and beautiful species, *Labr. lineatus*, Cuv., *Sciæna lineata*, Bloch, 304, and *Perca saxatilis*,

from it, and I think I have been fortunate enough to discover sufficient characters for that purpose.

* *Perc. flavescens*, Cuv. and Val. II, p. 46;—*P. serrato-granulata*, Ib. 47;—*P. granulata*, Ib. 48, and pl. ix;—*P. acuta*, Ib. 49, and pl. x;—*P. gracilis*, Ib. 50.

Add, *P. Plumieri*, or *Sciæna Plumieri*, Bl. 306, or *Centropome Plumier* and *Cheilodiptère chrysoptère*, Lacep. III, xxxiii;—*P. ciliata*, Kuhl;—*P. marginata*, Cuv. and Val. 53.

Bloch, Schn. pl. 20, (the Rock-fish), with longitudinal blackish stripes*.

We might also separate from *Labrax* a species of the United States, whose scales extend to the maxillary bone—*Labrax mucronatus*, Cuv. and Val. II, xii. The

LATES, Cuv.,

The Varioles, hardly differ from the Perches, except in having deep notches and even a small spine at the angle of the preoperculum, and also deeper notches in the sub-orbital and humeral bones.

Lates niloticus, Cuv.; *Perca nilotica*, L.; *Keschr* of the Arabs, Geoff. Egyp. Poiss. pl. ix, f. 1. A very large and excellent fish of a silver colour, known to the antients by the name of *Latus* or *Lates*.

Other species are found in the rivers of India†.

CENTROPOMUS, Lacep.

The Centropomes have the preoperculum dentated, but the operculum obtuse and unarmed. Only one species is known‡.

Centrop. undecimalis, Cuv.; *Scicæna undecimalis*, Bloch, 305; Cuv. and Val. II, xiv. A large and excellent fish, known throughout the hot parts of America by the name of *Pike*, whose muzzle, in fact, is depressed like that of our true Pike; but its teeth are small and crowded, and all its remaining characters are those of Perches with two dorsal fins; it is of a silver colour tinged with greenish; a blackish lateral line§.

GRAMMISTES, Cuv.,

Have the preoperculum and operculum armed with spines, but without notches; the dorsals approximated; scales small, and as if buried in the epidermis; no sensible spine to the anal fin.

The species are small, with longitudinal white streaks on a blackish ground. They inhabit the Indian Ocean||.

ASPRO, Cuv.,

Have the body elongated; the two dorsals separate; ventrals broad;

* It is also the *Perca Mitchilli*, New York Trans. v. I, 413. Add, *Perca elongata*, Geoff. Eg. pl. xix, 1;—*Labr. waigiensis*, Less. and Garn., Cuv. and Val. II, 33;—*Labr. japonicus*, Cuv. II, 85.

† The *Pêche naire* of Pondicherry, or *Cockup* of the English at Calcutta (*Lates nobilis*, Cuv.), Russ. II, cxxxi, Cuv. and Val. II, xiii, which is also the *Holocentre heptadactyle*, Lacep.;—*Holoc. calcarifer*, Bl. 244.

‡ Lacep. in his genus *Centropomus*, comprehends several Fishes which have not its characters, such as the *Labrax lupus*, the *lates*, &c.

§ Bl. pl. 305, has improperly given it a red tinge; the *Sphyrène orvert*, Lacep. V, pl. iv, f. 2, is nothing else than a bad figure of this fish; it is also the *Camuri* of Marcgrave.

|| *Gram. orientalis*, Bl., Cuv. and Val. II, pl. xxvii. *La Sciène rayée*, Lacep. IV, 323; his *Perséque triacanthé*, Ib. 424; his *Per. pentacanthé*, Ib.; his *Bodian six raies*, Ib. 302; his *Centropome six raies*, Ib. 690; the *Perca bilineata*, Thunb. Nov. Act. Stokh. XIII, pl. v, p. 142, appear to be varieties of it.

teeth small and dense as the pile on velvet; head depressed; the muzzle extending beyond the mouth, and terminating in a rounded point.

Two species inhabit the fresh waters of Europe; their flesh is delicate and agreeable.

Aspro vulgaris, Cuv.; *Perca asper*, L.; Bl. 107, 1 and 2; Cuv. and Val. II, xxvi. From the Rhone and its tributaries; greenish; three or four blackish vertical bands; eight spines in the first dorsal.

A. Zingel; *Perca Zingel*, L.; Bl. 105. From the Danube; larger than the vulgaris, but similar as to colours; thirteen spines in the first dorsal.

This division also comprises some fishes whose singularity of conformation gives rise to several subgenera.

HURO, Cuv. and Val.

The Hurons have all the characters of a true Perch, except that the preoperculum is not dentated*.

ETELIS, Cuv. and Val.

All the characters of a true Perch: hooked teeth in the jaws, but not as in the Lucio-Perca, in the palate†.

NIPHON, Cuv. and Val.

Teeth as in the Perch, and strong spines at the lower part of the preoperculum, and on the operculum‡.

ENOPLOSUS, Lacep.,

Have the characters of the Perches; angle of the preoperculum more deeply dentate; the body much compressed, and, together with the two dorsals, of great vertical height§.

DIPLOPRION, Kuhl and Van Hasselt,

Have all the characters of a Perch; body compressed; a double dentated border on the lower part of the preoperculum, and two spines on the operculum||.

APOGON, Lacep.

The Surmulletts have the body short, furnished, as well as the opercula, with large scales that are easily dislodged; the two dorsals very separate, and a double dentated border on the preoperculum. They are small fishes, and generally red. One of them,

Ap. rex mullorum, Cuv.; *Mullus imberbis*, L.; commonly called

* *Huro nigricans*, Cuv. and Val. II, pl. xvii.

† *Etelis carbunculus*, Ib. pl. xviii.

‡ *Nippon spinosus*, Ib. XIX.

§ *Enoplosus armatus*, Ib. XX, or *Chætodon armatus*, J. White.

|| *Diploprion bifasciatum*, Cuv. and Val. II, xxi.

Roi des Rougets, Cuv., Mém. du Mus. I, 336, and pl. xi, f. 2; three inches long; red; a black spot on each side of the tail; is found in the Mediterranean*.

CHEILODIPTERUS, *Lacep.*,

Combine all the characters of the Surmullet, differing only in the fangs or long and pointed teeth, with which the jaws are armed.

They inhabit the Indian seas, are small, and generally marked with longitudinal streaks†.

POMATOMUS, *Riss.*,

Have two separate dorsals like the Surmullet, and the scales dislodged with the same facility; but the preoperculum is simply striate, the operculum emarginate, and the eye enormous; very small teeth, dense as the pile on smooth velvet.

Pomat. telescope, Risso; Cuv. and Val. II, xxiv. The only species known; it inhabits the Mediterranean, and is excessively rare.

A second subdivision comprises the Percoides with two dorsal fins, and long and pointed teeth mingled with those that are small and dense as the pile on velvet.

AMBASSIS, *Commers.*,

Have nearly the same form as that of the Surmullet; a double notch towards the lower part of the preoperculum; the operculum terminating in a point. They are distinguished from the Surmullet by the contiguity of their two dorsals, and by a spine before the first.

They do not perhaps strictly belong to this family, for there are no appendages to the pylorus.

These are small fresh-water fishes of the East Indies, which swarm in the pools and rivulets; several of them are transparent‡.

One of them is common in a pond in the Island of Bourbon where they are prepared as anchovies—*Ambassis Commersonii*, Cuv. and Val. II, xxv§.

To this division belongs the

LUCIO-PERCA, *Cuv.*,

The Sandres, called by the French *Brochets-Perches*, or *Perch-Pike*,

* This is the *Apogon rouge*, Lacep.; the *Corvulus*, Gesner, p. 1273; the *Amia* of Gronovius, Zooph. IX, 2; the *Centropomus rubens*, Spinol. An. Mus. X, XXVIII, 2; the *Dipterodon ruber*, Rafin. Caratt. No. 715, &c. The *Dipterodon hexacanthæ*, Lacep. III, pl. iv, f. 2, and the *Ostorinque fleurieu*, Id. III, xxxii, 2, also belong to this genus. For the numerous species of this genus foreign to Europe, see Cuv. and Val. II, 151, et seq.

† *Cheilod. 8-vittatus*, Cuv., Lacep. III, xxxv, 1; which is his *Cheilod. rayé*, III, p. 543, and his *Centropome macrondon*, IV, 273;—*Cheilod. arabicus* (*Perca lineata*, Forsk.), Cuv. and Val. II, pl. xxiii;—*Ch. 5-lineatus*, Ib. p. 167.

‡ Several of them are comprised by M. Ham. Buchanan among his Chandæ.

§ It is the *Centropome ambrasse*, Lacep. IV, 273, and his *Lutjan gymnocéphale*, IV, 216, and III, pl. xxiii, f. 3. For the other species, see Cuv. and Val. II, 181, et seq.

because to the characters of a Perch, they add teeth somewhat resembling those of the Pike. The edge of their preoperculum has but one simple emargination; their dorsal fins are separate; some of the maxillary and palatine teeth are long and pointed.

Luc. sandra, Cuv.; *Perca lucio-perca*, L.; *Sandre d'Europe*; Bl. pl. li; Cuv. and Val. II, pl. xv. Is an excellent fish, of the lakes and rivers of Germany, and of Eastern Europe. Longer than the Perch; greenish, with vertical brown bands; from three to four feet in length*.

A second division comprises the Perches with seven branchial rays and one dorsal. They are subdivided on grounds nearly analogous to those which have led to the subdivision of the preceding ones; their teeth are either hooked, or are all dense like the pile on velvet; notches and spines on the opercula, &c.

In the subdivision, furnished with hooked teeth, we find,

SERRANUS, Cuv.

The Serrans have the preoperculum dentate; the bony operculum terminating in one or several points. This genus contains a vast number of species, and may be subdivided as follows:

SERRANUS, properly so called,

Or the Sea-Perch. No apparent scales on either of the jaws. Several beautiful species inhabit the Mediterranean, such as,

Perca scriba, L.; Cuv. and Val. II, xxviii, so named from having some irregular blue lines on the head†.

Perca cabrilla, L.; Cuv. and Val. II, xxix. Three oblique bands on the cheek‡. It is also found in the ocean. This species, and perhaps the preceding one, were known to the Greeks by the name of *Chane*, and were thought to consist exclusively of females. Cavolini assures us, that, in every specimen he examined, he found a roe, at the lower end of which was a whitish part, which might be considered as the milt. He believes them to be hermaphroditical. The

ANTHIAS, Bl., partim,

Are Serrani, in which both jaws and the end of the muzzle are armed with very obvious scales§. The most remarkable species is,

* Add, the *Berschik*, or *Sandre bâlard* (*Perca volgensis*, Gm.);—the *Lucio-perca americana*, Cuv. and Val. II, pl. xvi, p. 122.

† It is also the *Perca marina*, Brunnich; the *Holocentrus marinus* of Laroche; the *Hol. argus* of Spinola, and the *Hol. maroccanus* of Bloch. The *Hol. fasciatus*, Bl. 240, appears to us nothing more than the same species somewhat changed.

‡ It is also the *Hol. virescens*, Bl.; the *Serranus flavus* and *cabrilla* of Rip.; the *Labrus chana* of Gmel., or *Holocentrus chani*, Lacép.; the *Bodian hiatule*, Id. &c. Add the *Sacchetto*, *Labrus hepatus*, L.; and *Lab. adriaticus*, Gm., or *Holocentrus siagonotus*, Laroche, &c.;—*Serranus vitta*, Quoy et Gaym., Voy. de Freycin., Zool. LVIII, 2; *Hol. argentinus*, Bl. 235;—*Serr. radialis*, Q. et G. 316;—*Serr. fascicularis*, Cuv. et Val. II, xxx, and the other species described, Id. II, p. 239—249.

§ Most of our Merræ are placed by Bloch among his Anthias, but we restrict this genus to the species answering to our definition of the same. So little regard has

Anth. sacer, Bl.*, pl. cccxv; *Barbier de la Méditerranée*, Cuv. and Val. II, xxxi. A most beautiful fish, of a fine ruby red, changing to gold and silver, with yellow bands on the cheek. The third dorsal ray is more than double the height of the others; the ventral fins are very long, and the lobes of the caudal fin terminate in filaments, the lower of which is the longest†.

MERRA,

Serrani, whose maxillary is destitute of scales, but whose lower jaw is covered with small ones. There is one of them found in the Mediterranean; the

Perca gigas, Gm. Of a clouded brown; three feet and more in length; it is also taken in the ocean.

The Merræ, foreign to Europe, are extremely numerous; the dentation of the preoperculum in several becomes almost insensible‡; but, generally, they can only be distinguished by their colours.

There are many in which the body is dotted with colours more or less vivid§, and others, in which it is marked with crowded spots||.

Some in which it is longitudinally striped¶, or transversely**, or mottled in large patches††, or divided into two colours‡‡, or, finally, of a

Bloch had to exactness, that his *Anthias sacer* does not even possess the character attributed to the genus *Anthias* of a spineless operculum.

* This term *Sacer* was applied by the ancients to their *Anthias*, a large Fish very different from the one here described. See Cuv. et Val. II, p. 255 et seq.

† Add, *Serranus oculatus*, Cuv. et Val. II, xxxii, and the other species described, Ib. p. 262—270.

‡ These, when the muzzle is naked, constitute the *BODIANUS*, Bloch; they only differ from most of the *HOLOCENTRI* of the same author in this diminished dentation. The *HOLOCENTRI*, when the muzzle is scaly, are called *EPINEPHELI*, and where this is the case with the *BODIANI*, they are called *CEPHALOPHOLES*. The *LUTJANI* and *ANTHIAS* of Bloch differ from the *HOLOCENTRI*, in the absence of the spines on their operculum; in the first ones the muzzle is naked; it is scaly in the others; but all these characters, of but little importance in themselves, are very badly applied to the species.

§ They are the *Jacob Evertsen* of the Dutch, such as, *Bodianus guttatus*, Bl. 224;—*Cephalopholis argus*, Bl., Schn., pl. 61;—*Bodianus bænak*, Bl. 226;—*Holoc. auratus*, Ib. 236;—*Hol. cæruleo-punctatus*, Id. 242, 2;—*Labrus punctulatus*, Lacép. III, xvii, 2, &c.; and in America, *Perca guttata*, Bl. 312, or *Spare sanguinolent*, Lacép. IV, iv, 1;—*P. maculata*, Bl. 313, or *Spare atlantique*, Lac. IV, v, 1;—*Johnius guttatus*, Bl. Schn., or *Bonaci-arara*, Parra, XVI, 2;—*Lutjanus lumulatus*, Bl. Schn., or *Cabrilla*, Parra, XXXVI, 1;—*Bodianus guativeri*, Parra, V;—*Holoc. punctatus*, Bl. 241, or *Pyraxipiraxa*, Marcg. 152; *Gymnocephalus ruber*, Bl. Schn. 67, or *Carauna*, Marcg. 147;—*Bodianus apua*, Bl. 229.

|| *Epinephelus merra*, Bl. 329;—*Holoc. pantherin*, Lacép. III, xxvii, 3;—*Serranus bontoo*, Cuv., Russel, 128;—*Serr. suillus*, Russ. 127;—*Labrus leopardus*, Lacép. III, xxx, 1;—*Holoc. salmonoides*, Ib. XXXIV, 3;—*Bodianus melanurus*, Geoffr. Egypt., XXI, 1.

¶ *Sciæna formosa*, Shaw, Russel, 129.

** *Holoc. tigrinus*, Bl. 237; Seb. III, xxvii;—*Hol. lanceolatus*, Bl. 242, 1;—*Anthias orientalis*, Id. 326;—*Anth. striatus*, Id. 324, which is also the *Anth. cherna*, Bl., Schn., Parra, XXIV; and the *Spare chrysomelane*, Lacép.

‡‡ *Serranus geographicus*, Kuhl, Cuv. et Val. II, p. 322.

†† *Serranus flavo-cæruleus*, Cuv., which is the *Holoc. gymnose*, Lacép. III, xxvii, 2; his *Bodian grosse tête*, III, xx, 2, and his *Holocentre jaune et bleu*, IV, p. 369. It is also the *Serran bourignon*, Quoy et Gaym., Voy. Freycin., Zool., pl. lvii, 2.

more or less uniform tint*. Very few of them possess characters drawn from very apparent varieties of form. We will cite, however, the

Serr. altivelis, Cuv.; Cuv. et Val. II, xxxv. Which has a higher dorsal than the others; it is sprinkled with round and black spots, on a ground of light brown; and

Serr. phaeton, Ib. pl. xxxiv, whose two middle caudal rays unite in a filament as long as the body.

We have separated from the Serrani, the

PLECTROPOMA, Cuv.,

Which only differ from them in the more or less numerous teeth of the lower edge of the preoperculum, which incline obliquely forwards†, and the

DIACOPE, Cuv.,

Whose character consists of an emargination near the lower edge of the preoperculum, which receives a tuber of the interoperculum. The Indian Ocean produces some large and splendid species‡.

MESOPRION, Cuv.

These have, with the dental characters and fins of the Serrani and their dentated preoperculum, an operculum terminating in an obtuse angle, not spinous§.

Numerous and beautiful species inhabit the two oceans||. Several of them are very large, and excellent for eating.

* *Holocentrus oncus*, Bl. 234;—*Epinephelus marginalis*, Bl. 328, or *Holoc. rosmare*, Lacép. IV, vii, 2;—*Hol. oceanique*, Lacép. IV, vii, 3;—*Epinephelus ruber*, Bl. 331. For various other species of which there are no figures, see descriptions in the second volume of our History of Fishes.

† *Pl. melanoleucum*, Cuv.; or *Bodian melanoleuque*, Lacép.; or *Labre lisse*, Id. III, xxiii, 2; or *Bodian cyclostome*, Ib. XX, 1;—*Holoc. leopard*, Lacép. IV, p. 337; Cuv. et Val. II, xxxvi;—*Bodianus maculatus*, Bl. 228, or *Plectropome ponctué*, Freycin. Zool. XLV, 1;—*Holocentrus unicolor*, Bl., Schn., §Seb. III, lxxvi, 10; *Plect. puella*, Cuv. et Val. II, xxxvii, and the other species described in the second Vol. of our History of Fishes.

‡ *Diac. Sebæ*, Cuv., Seb. III, xxvii, 2, and Russel, 99;—*D. rivulata*, Cuv.; Cuv. et Val. II, xxxviii;—*D. macolor*, Cuv., Renard, I, ix, 60;—*D. octolineata*, Cuv., or *Holoc. bengalensis*, Bl. 246, the same as the *Labrus 8-lineatus*, Lacép. III, xxii, 1, and as the *Sciaena kasmira*, Forsk.; *Hol. 5-lineatus*, Bl. 239, is a variety of it;—*D. notata*, Cuv., Russel, 98; *D. quadriguttata*, Cuv., or *Sparus lepisure*, Lacép. III, xv, 2;—*D. calveti*, Quoy et Gaym. Voy. Freycin. Zool. LVII, 1, and several other species described in the second Vol. of our History of Fishes.

§ Most of them were comprised in the genus *Lutjanus* of Bloch, but were there mingled with species of other families, either Scienoides or Labroides, of which we have made other genera.

|| *Mesopr. unimaculatus*, Russel, 97;—*Anthias, Johnii*, Bl. 318;—*Coius catus*, Buchan, 38, f. 30;—*M. 5-lineatus*, Russel, 110;—*M. monostygma*, Cuv., Lacép. III, xvii, 1;—*M. unnotatus*, Cuv., Cuv. et Val. II, xxix, Duham. part II, sect. IV, pl. iii, f. 2, and probably *Sparus synagris*, L., Catesb. II, xvii, 1;—*M. buccanella*, Cuv., the figure of which was taken by Bloch from Plumier, and, with some alteration, given as the *Sparus erythrinus*, pl. 274;—*Bod. aia*, Bl. 227, or *Acara aia*, Maregr. 167;—*Mes. chrysurus*, Cuv. et Val. II, xl, which is also the *Sparus chrysurus*, Bl. 262, or *Acara pi-*

We now pass to the Perches with seven branchial rays, and a single dorsal, which have the teeth dense as the pile on velvet.

ACERINA, Cuv.

The Gremilles are characterized by cavities or depressions on the bones of the head, and by their preoperculum and operculum having only small spines, but not dentated. Two fresh-water species are found in Europe:

A. cernua; *Perca cernua*, L.; *Perche goujonnière*, Bl. 53, 2; Cuv. et Val. III, pl. xli. (The Common Gremille). A small fish of an agreeable flavour, very common in all the fresh-water streams of Europe; it is of an olive colour, spotted with brown.

A. schraitzer; *Perca schraitzer*, L.; the *Schrætz*, Bl. 332. Larger, and has interrupted blackish lines on the sides: it inhabits the Danube*.

RYPTICUS, Cuv.

The Savonniers, or Soap-worts, also have only small spines on the opercular pieces; the scales, like those of the Grammistes, are small, and concealed in a thick epidermis; particularly distinguished from the Grammistes by the single dorsal. There is one of these in America of a violet black, *Anthias saponaceus*, Bloch., Schn., Parra, xxiv, 2, (The Saponaceous Anthias), which owes its name to its soft skin and the layer upon it of a frothy viscosity†.

POLYPRION, Cuv.

The Cerniers have not only dentations on the preoperculum and spines, or the operculum, but there is on this last bone a bifurcated and very rough crest, and the bones of the head are generally covered with asperities.

The Mediterranean possesses a species which becomes enormous, *Polyp. cernium*, Valenc.; Mém. du Mus. tom. XI, p. 265; and Cuv. and Val. III, pl. xlii‡. It is clouded with brown on a lighter ground.

CENTROPRISTIS, Cuv.,

Possess all the characters of the Serrans, except that they want the canines, and that all the teeth are small and dense as the pile on velvet; preoperculum dentated and operculum spinous.

Centrop. nigricans, Cuv.; *Coryphæna nigrescens*, Bl., Schn.;

tamba of Marcgr. 155;—the *Anthias rabirrubia*, Bl., Schn., Parra, XXII, 1;—the *Spare demi-lune*, Lacép. IV, iii, 1; and the *Colas* of Guadeloupe, Duham. Sect. IV, pl. xii, 1;—*M. cynodon*, Cuv., or *Anthias caballeroie*, Bl., Schn., Parra, XXV, 1;—*Anth. jocu*, Bl., Schn., Parra, XXV, 2;—*Sp. tetracanthus*, Bl. 279, which is also the *Vivanet gris*, Lacép. IV, iv, 3; and the *Lutjanus acutirostris*, Desmar.;—*M. sillao*, Russel, 100;—*M. lunulatus*, Cuv., Mungo Park, Lin. Trans. III, xxxv, 6;—*Lutj. erythropterus*, Bl. 249;—*Lutj. lutjanus*, Id. 245;—*Sparus malabaricus*, Bl., Schn.;—*M. rangus*, Cuv., Russel, 94;—*M. rapilli*, Id. 95;—*Alphestcs gembra*, Bl., Schn., pl. 51, 2, and the other species described in our second volume of the History of Fishes.

* Add, *Perca acerina*, Guldenst., Nov. Comment. Petrop. XIX, 455.

† Add, *Rypticus arenatus*, Cuv. et Val. III, pl. xlii.

‡ The *Amphiprion australis*, Bl. Schn. pl. 47, or *americanus*, Ib. p. 205; and the *Amph. oxygencios*, Ib., or *Perca prognathus*, Forst., do not appear to us to be distinguishable from the *cernium*.

Cuv. and Val. III, pl. xlv. (The Black Perch). Blackish brown; the caudal fins trilobate when young. It becomes large, and is found in the United States*.

GRISTES, Cuv.

The Growlers only differ from *Centropristis* in the margin of the preoperculum, which is entire and without dentations†.

Here the genus *PERCA*, such as it was defined by Artedi and Linnæus, terminates; but there remain many fishes which approach it, although peculiar characters compel us to arrange them in separate genera.

We begin with those *Perches* which have less than seven branchial rays. We may also subdivide them according to the number of their dorsal fins, and the nature of their teeth.

Of those with a single dorsal fin, some have hooked teeth among the others: they are the

CIRRHITES, Commers.

The *Cirrhites*, which have the preoperculum, as in *Mesoprion*, dentated, and the operculum terminating in an obtuse angle; distinguished by the inferior rays of their pectoral fin, which are stouter and not branched, extending a little beyond the membrane. They have six rays to the branchiæ. They all inhabit the Indian Ocean‡.

Others of the *Perches*, with less than seven branchial rays, have only the teeth dense as the pile on velvet, or, at least, have no hooked ones.

CHIRONEMUS, Cuv.

The *Chironemes* have the inferior part of the pectoral fins with the same simple rays as the *Cirrhites*§.

POMOTIS, Cuv.

The *Pomotis* are fishes with a compressed and oval body, characterized by a membranous prolongation at the angle of the operculum. They inhabit the rivers of America||.

* This is also the *Lutjan trilobé*, Lacep. II, xvi, 3, and the *Perca varia*, Mitchill, Trans. New York, I.—Add, *Perca trifurca*, L.;—*La Scorpène de Waigiou*, Quoy and Gaym. Freycin. Zool. LVIII, 1; and the other species described in the third vol. of our History of Fishes.

† The *Labre salmoïde*, Lacep. IV, v, 2, or *Cychla variabilis*, Lesueur, Ac. Nat. Sc. Phil., Cuv. and Val. III, pl. xlv;—*Gr. macquariensis*, Ib. p. 58.

‡ The *Cirrhite tacheté*, Lacep. V, 3, which is also his *Labre marbré*, III, v, 3, and p. 492;—the *Cirrhite pantherin*, or *Spare pantherin*, Ib. IV, vi, 1, and p. 160, and Seb. III, xxvii, 12;—*Cirrhites vittatus*, Cuv., Renard, I, xviii, 102;—*Cirrh. aprinus*, Cuv. et Val. III, xlvii, &c.

§ One species only is known, *Chiron. georgianus*, Cuv. et Val. III, p. 78; from New Holland.

|| *Pomotis vulgaris*, Cuv., or *Labrus auritus*, L., called *Pond-Perch* in the United States. Catesb. II, viii, 2, Cuv. et Val. III, pl. 49.

CENTRARCHUS, Cuv.,

Have the characters of the Pomotis, numerous spines in the anal fin, and, further, a group of teeth, dense as the pile on velvet, on the tongue*. From America.

PRIACANTHUS, Cuv.

The Priacanthes have the body oblong, compressed, completely covered, as well as the entire head, and even both jaws, with small rough scales; the preoperculum dentated, and its salient angle spiniform, whilst it is itself dentated. Found in the seas of hot climates†.

DULES, Cuv.

The Doules have the operculum, as in *Centropristis*, terminating in spines; the preoperculum dentated, and the teeth dense as the pile on velvet; but six rays to the branchial membrane‡.

D. rupestris, Cuv., a species nearly resembling a carp, and esteemed for its taste, is found in the fresh waters of the isles of Bourbon and the Mauritius, where it is much esteemed§.

THERAPON, Cuv.

The Therapons have a preoperculum dentated, an operculum terminated by a stout spine; a strongly emarginate dorsal fin between the spinous and soft part: the teeth of the external row pointed and stronger than the rest. In some, the teeth of the vomer fall out at an early period. They inhabit the waters of India, and are remarkable for a natatory bladder, divided into two compartments by a stricture||.

It is hardly possible to separate the *DATNIA* from them, although they want the palatine teeth; their profile is more rectilinear; their dorsal fin less emarginate¶.

PELATES, Cuv.

Have the same internal and opercular characters as the Therapons; but their teeth are uniformly dense as the pile on velvet, and the dorsal but slightly emarginate**.

* *Centrarchus æneus*, Cuv., or *Cychla ænea*, Lesueur, Ac. Nat. Sc. Phil.;—*C. sparoides*, or *Labre sparöide*, Lacep. III, xxiv, 2;—*Labre iris*, Lac. IV, v, 3, which is also his *Labre macroptère*, III, xxiv, 1.

† *Anthias macrophthalmus*, Bl. 319, or *Catalufa*, Parra, XII, 1;—*Anthias boops*, Bl. Schn. 308;—*Sciæna hamruhr*, Forsk.;—*Labrus cruentatus*, Lacep. III, ii, 2, and the other species described in our third volume.

‡ *Dules auriga*, Cuv. et Val. III, li;—*D. tæniurus*, Ib. LIII, and the other species described in the third volume.

§ This is the *Centropome de roche*, Lacep. IV, 273.

|| *Holocentrus servus*, Bl. 238, 1, or *Sciæna jerbua*, Forsk.;—*Hol. 4-lineatus*, Bl. 238, 2;—*Ther. puta*, Cuv. Russel, pl. 126;—*Ther. theraps*, Cuv., Cuv. and Val. III, liv, and the other species described in our third volume.

¶ *Datnia Buchanani*, or *Coius datnia*, Buchanan, pl. ix, f. 29, and Cuv. and Val. III, lv;—*Dat. cancellata*, Ib. p. 144.

** *Pelates quinque-lineatus*, Cuv. et Val. III, 56.

HELOTES, Cuv.

Also very similar; have the dorsal fin deeply emarginate, and are particularly distinguished by their anterior range of teeth being trilobate*.

Most of these fishes have longitudinal blackish lines on a silvery ground.

The Perches with less than six branchial rays and two dorsals constitute but two genera.

TRICHODON, Steller.

The preoperculum of which has very strong spines, and the operculum of which terminates in a flat point; they have no scales; their mouth is cleft almost vertically. But one species is known,

Tr. Stelleri, Cuv.; *Trachinus trichodon*; Pall. Mém. de Petersb. IV, xv, 8, and Cuv. and Val. III, lvii. From the north of the Pacific†.

SILLAGO, Cuv.

Head somewhat elongated and pointed; mouth small; teeth dense, as the pile on velvet, in the jaws and before the vomer; an operculum terminating in a small spine; six branchial rays; two contiguous dorsals; spines of the first slender, the second long and low.

They are all from the Indian Ocean, and much esteemed for the flavour and delicacy of their flesh. The most remarkable species is

Sill. domina, Cuv.; *Le Peche Madame* de Pondicherry. Brownish, and distinguished by the first ray of its dorsal, elongated into a filament as long as the body. Its head is scaly, and the eye very small. There is another,

Sill. malabarica; *Sciæna malabarica*, Bl. Schn.; *Soring*, Russel, 113; *Le Peche bicout*; not above a foot long, and fawn-coloured, which is considered one of the best fishes of India‡.

We now pass to those Perches which have more than seven rays to the branchiæ. Three genera are known, all of which present the following peculiarity, that their ventral fins have a spine and seven or more soft rays, while in other Acanthopterygians there are never more than five soft rays.

HOLOCENTRUM§, Artedi.

The Holocentri are beautiful fishes with brilliant and dentated scales,

* *Helotes 6-lineatus*, Cuv. et Val. III, lvii, or *Esclave six lignes*, Quoy et Gaym., Voy. de Freycin. Zool. LXX, 1.

† This fish having neither jugular ventrals, nor an elongated posterior dorsal, nor a strong spine on the operculum, nor seven rays in the branchiæ, cannot be a *Trachinus*, as was thought by Pallas and Tilesius.

‡ Add, *Atherina sihama*, Forsk., or *Platicephalus sihamus*, Bl. Schn. Ruppel, Poiss. pl. iii, f. 1; *Sillago maculata*, Quoy et Gaym. Freycin. pl. iii, f. 3.

§ We restrict this genus to species answering to the definition of it given by Artedi, Seb. III, ad tab. xxvii, 1, and, like him, we give a neuter termination to this

in which the operculum is dentated and spinous, and the preoperculum not only is dentated, but it has a stout spine at the angle, which is directed backwards. They are found in the hot parts of both oceans*.

MYRIPRISTIS, Cuv.

These have all the brilliancy, shapes, and scales of the *Holocentrus*, but their preoperculum has a dentated double border, and wants the spine at the angle. This genus is remarkable for a natatory bladder, divided into two compartments, the anterior part of which is bilobate and attached to the cranium in two places, where the latter is only closed by a membrane, and which correspond to the sacs of the ears. They inhabit the hot parts of both oceans†.

BERYX, Cuv.

The *Beryx* differ from the *Myripristis* in having but a single short dorsal fin, with but a few small spines, almost hidden in its anterior edge; ten soft rays in the ventral fins‡. It is impossible to remove from it the

TRACHICHTYS, Shaw.

The *Trachichtes*, which, with the same roughness that exists in the three preceding genera, and the same little dorsal fin as in the *Beryx*, have a flat spine at the lower part of the preoperculum, and one on the shoulder; their abdomen and the sides of their tail are covered with large carinated scales§.

All the *Perches* of which we have hitherto spoken, have their ventral fins inserted under the pectorals; there are some genera, however, in which they are differently situated.

The *PERCOIDES JUGULARES* have their throat further forwards than the pectoral fins.

TRACHINUS, Lin.

The *Weevers*, or *Otter Pikes*, have the head compressed, approximated

name to prevent it from being confounded with the *Holocentrus* of Bloch and of Lacépède, which contains various other species, Serrani particularly.

* *Holocentrum longipinne*, Cuv., which is the *Hol. sogho*, Bl. 232; and his *Bodianus pentacanthus*, or the *Jaguaraca* of Marcgr. 147; it is also the *Sciæna rubra*, Bl. Schn. Catesb. II, ii, 2; and the *Amphiprion matejeulo*, Bl. Schn. Parra, XIII, 2;—*Hol. orientale*, Cuv. Seb. III, xxvii, 1;—*Hol. rubrum*, Bennet, Fishes of Ceylon, pl. iv;—*Hol. leo*, Cuv. Ren. I, xxvii, 148, a very bad figure;—*Sciæna spinifera*, Forsk.;—*Hol. hastatum*, Cuv. et Val. III, lix;—*Hol. diadema*, Lacep. III, ix, 3, or *Perca pulchella*, Bennet, Zool. Journ. III, ix, 3;—*H. sammara*, or *Sciæna sammara*, Forsk. or *Labre anguleux*, Lacep. III, xxii, 1, and the other species described in our third volume.

† *Myripristis jacobus*, Cuv., Desmar. Diet. Class. d'Hist. Nat.;—*M. japonicus*, Cuv. et Val. III, lviii;—*M. bolche*, Cuv. Russel, 105;—*M. parvidens*, Cuv. Id. 109;—the *Lutjan hexagone*, Lacep. IV, 213; his *Holocentre Thunberg*, Ib. 367; his *Centropome rouge*, Ib. 273; the *Sciæna murdjan*, Forsk. also belong to this genus. See its history in the third volume of our Ichthyology.

‡ *Beryx decadactylus*, Cuv. et Val. III, 222;—*B. lineatus*, Ib. 226, and pl. lxx.

§ *Trachichtys australis*, Shaw, Nat. Misc. No. 578: and Gen. Zool. IV, part II, p. 260.

eyes, and an oblique mouth; the first dorsal fin very short, the second very long; pectoral fins large, and a stout spine on the operculum. They generally remain concealed in the sand; wounds inflicted by the spines of their first dorsal are much dreaded, but their flesh is agreeable. Several species are found in the Atlantic, &c. The most common on our coasts is,

Trach. draco, L.; Salv. 72; *Trach. lineatus*, Bl. Schn. pl. x; and Penn. Brit. Zool. III, xxix. (The Dragon Weever). Grey and reddish, with blackish spots; blue streaks and yellow tints; thirty rays to the second dorsal fin; flanks obliquely striated. We have a small species, the

Trach. vipera, Cuv.; *Boideroc*, Penn. 28; Bloch, 61. (The Otter-Pike). Paler, with smooth flanks and twenty-four rays in the second dorsal. It is more dreaded than the preceding species, because as it is smaller in size persons are more liable to be stung by it. The Mediterranean contains,

Trach. araneus, Riss.; Salvian, 71; copied by Willough. pl. S. 10, f. 2. Higher; twenty-eight rays to the second dorsal fin; six or eight black spots along the flank.

Trach. radiatus, Cuv.; Cuv. and Val. III, lxxii. Twenty-five rays in the second dorsal fin; head shagreened and rough; flanks alternately marked with large black rings and full spots.

The Weevers of remote seas are unknown to us.

PERCIS, *Bl. Schn.*

These fishes, in some respects, are the representatives of the Weevers in the seas of hot climates. They principally differ from them in the depression of their head, and by having hooked teeth in the anterior part of the jaws and vomer; but there are none in the palate. Their first small dorsal fin is somewhat more closely united to the long one which follows it*.

PINGUIPES, *Cuv.*

Have their forms more heavy than the Percis; strong conical teeth; fleshy lips and teeth in the palate; thick ventrals.

Ping. brasiliensis, Cuv. and Val. III, lxxiv. From Brazil, the only species known. The

PERCOPHIS, *Cuv.*

Have the body, on the contrary, much elongated; some of the teeth are long and very pointed, and the end of the lower jaw projects.

Percoph. brasiliensis, Cuv.; *Perc. Fabre*, Quoy and Gaym.,

* *Percis maculata*, Bl. Schn. pl. 38;—*P. semi-fasciata*, Cuv. et Val. III, lxxiii;—*P. cylindrica*, or *Sciæna cylindrica*, Bl. 299, 1, which is also the *Bodianus Sebæ*, Bl. Schn. Seb. III, xxvii, 16;—*P. cancellata*, Cuv., or *Labre tétrecanthe*, Lacép. III, p. 473; and II, pl. xiii, f. 3, which is also his *Bodian tétrecanthe*, IV, 302;—*P. ocellata*, Renard, I, vi, 42;—*P. colias*, Cuv., or *Enchelyopus colias*, Bl. Schn. p. 54, and the other species described in our third volume of Ichthyology.

Voy. Freycin., Zool., liii, 1, 2. The only species known: also from Brazil.

One of the most remarkable genera of the Jugular Perches is that of

URANOSCOPUS, *Lin.*,

The Star-Gazers, so called because, on the superior surface of their nearly cuboid head, the eyes are so placed as that they appear constantly looking on the heavens: the mouth is cleft vertically; the lower part of the preoperculum is crenate, and there is a stout spine to each shoulder; but six rays in the branchiæ. In the mouth and before the tongue is a long and narrow slip, which can be protruded at will, and serves, it is said, to attract small fish, while it remains concealed in the mud. A remarkable peculiarity of their anatomy is the enormous size of the gall-bladder, a fact well known to the ancients*.

In some, the first dorsal, small and spinous, is separated from the second which is soft and long.

Uranos. scaber, L.; Bl. 173. (The Mediterranean Star-Gazer). Grey-brown, with irregular ranges of whitish spots. Although one of the most hideous of fishes, it is eaten. From the Mediterranean.

Very similar species are found in the Indian Ocean, and in Brazil†.

Others have but one dorsal in which the spinous and soft parts are united. They are all foreign to our seas‡.

In a third division of the Perches, the ventrals are inserted further back than the pectorals: they are the ABDOMINAL PERCHES. The first genus is

POLYNEMUS, *L.*

The Paradise Fish, so named, because several of the inferior pectoral rays are free, and form so many filaments§; the ventrals are not very far back, and the pelvis is still suspended to the bones of the shoulder. They are allied to the Perches by the teeth, dense as the pile on velvet, or bent back like those of a wool-card, which arm their jaws, vomer, and palate; but their snout is convex, and the vertical fins scaly as in many of the Scienoides: the two dorsals are separated, the preoperculum is dentated, and the mouth deeply cleft: they are found in all the seas of hot climates.

Pol. paradiseus and *Pol. quinquarius*, L.; Seb. III, xxvii, 2; Edw., 208; Russel, 285. (The Mango Fish). So called from its fine yellow colour: has seven filaments on each side, the first of which are twice the length of the body. The natatory bladder is

* Arist. Hist., An., lib. II, xv.

† Add *Uranosc. affinis*, *Ur. marmoratus*, *Ur. guttatus*, *Ur. filibarbis*, *Ur. Ygræcum*; new species described in our third vol. of Ichthyology.

‡ *Uranosc. lebeck*, Bl., Schn., p. 47; *Ur. monopterygius*, Ib. 49;—*Ur. lævis*, Ib., pl. viii;—*Ur. inermis*, Cuv. et Val. III, lxxi, and *Ur. cirrhosus*, two new species.

§ From the Greek *nema* (a thread).

wanting in this species, although it exists in all the others: it is the most delicious fish that is eaten in Bengal.

The filaments of the remaining Polynemi are shorter than the body, and their number is one of their specific characters. Some of them are large, and all are considered excellent food*.

In the succeeding genera the ventrals are altogether behind, and the pelvis no longer adheres to the bones of the shoulder. The first, for a long time, was even confounded with that of the Pikes: it is the genus

SPHYRÆNA†, *Bl. Schn.*

Large fishes of an elongated form, with two separated dorsals, an oblong head, the lower jaw of which projects in a point before the upper one, and part of whose teeth are large, pointed and trenchant. Their preoperculum is not dentated, nor their operculum spinous. There are seven rays to the branchiæ, and numerous pyloric appendages. One species is found in the Mediterranean.

Sph. vulgaris; *Esox sphyræna*, L.; *Sphyène spet*, Lacép.‡; Bl. 389; *Le Spet*; *Espeto* (the Spanish for Pike); which attains a length of more than three feet; back bronzed; belly silvery; brown spots when young.

Sph. picuda, Bl. Schn.; Parr., xxxv, 5, 2; Lac., V, ix, 3. A closely allied American species. The same country produces another,

Sph. barracuda, Cuv.; Catesb., II, pl. 1, f. 1. Which becomes much larger, and is nearly as much dreaded as the shark.

PARALEPIS, *Cuv.*

Small fishes resembling the Sphyrænæ, but whose second dorsal is so small and frail that it has been considered as adipose§.

MULLUS, *Lin.*

The Surmullets are rather closely allied to the Perches by several anatomical and external details, though the species which compose it present so many remarkable peculiarities that they might readily be made to constitute a separate family. Their two dorsals are far apart; the entire body and opercula are covered with large scales which are easily dislodged; the preoperculum is without dentations; the mouth is slightly cleft and but weakly armed with teeth, and above all they are distinguished by two long

* *Polyn. plebeius*, or *Emöi*, Brouss., Bl., 400;—*Pol. uronemus*, Cuv. Russel, 184;—*Pol. tetradactylus*, Shaw, Russel, 183;—*Pol. sextarius*, Bl. Schn., pl. iv;—*Pol. enneadactylus*, Vahl.;—*Pol. decadactylus*, Bl. 401;—*Polynemus americanus*, Cuv., which is the species improperly named by Bl., pl. 402, *paradisæus*, and of which M. de Lacépède has also improperly made a particular genus, his *Polydactyle plumier*, V, xiv, 3.

† From the Greek *sphuraina*, a dart.

‡ *Spet*, from *Espeto*, the Spanish name of the Pike.

§ Two or three small species described by Risso, 2d ed. f. 15 and 16, inhabit the Mediterranean.

cirri, which depend from the symphysis of the lower jaw. They are divided into two subgenera.

MULLUS, properly so called.

The Surmulletts have but three rays to the branchiæ, operculum spineless, and no teeth in the upper jaw; two broad plates of small teeth, as if paved, on the vomer; no natatory bladder. All the species are from Europe.

M. barbatus, L.; *Le Rouget*; Bl. 348, 2. (The Red Surmullet). Profile nearly vertical; of a fine lively red; celebrated for the flavour of its flesh, and for the amusement it afforded the Romans, who took much pleasure in contemplating the changes of colour it undergoes when dying*; most common in the Mediterranean.

M. surmuletus, L.; Bl. 57. (The Surmullet). Larger; profile less vertical; longitudinally striped with yellow; most common in the ocean.

UPENEUS, Cuv.

Have teeth in both jaws, but very often none in the palate; a small spine on the operculum; four rays in the branchiæ; a natatory bladder. All the species are from the seas of hot countries†.

FAMILY II.

OF THE ACANTHOPTERYGIANS,

The MAILED CHEEKS, contains a numerous series of fishes, to which the singular appearance of their head, variously mailed and protected, gives a peculiar aspect that has always caused them to be arranged in special genera, although they have many close affinities with the Perches. Their common character consists in having the suborbital bones more or less extended over the cheek and articulated behind with the preoperculum. The *Uranoscopus* is the only one of the preceding family which has any thing like it, but the suborbital bone of the latter, although very broad, is connected behind with the temporal bones, and not with the preoperculum.

Linnaeus divided them into three genera, *TRIGLA*, *COTTUS*, and *SCORPÆNA*; it has been found necessary, however, to subdivide them, and to add some of his *GASTEROSTEI*.

* Senec., Quest., Nat., III, c. xviii.

† *Mullus vittatus*, Gm., Lacép., III, xiv, 1; Russel, II, 158;—*M. Russelii*, Cuv., Russel, II, 157;—*M. bifasciatus*, Lacép., III, xiv, 2;—*M. trifasciatus*, Id., III, xv, 1, or *M. multibandæ*, Quoy et Gaym., Voy. Freycin., pl. 59, f. 1, and several other species described in the third Vol. of our Ichthyology.

TRIGLA, *Lin.**

The Gurnards are the fishes in which the above character is most strongly marked; an enormous suborbital bone completely covering the cheek, and even articulated by an immoveable suture with the preoperculum, so as to allow of no separate motion; sides of the head nearly vertical, giving it a form approaching that of a cube, or parallelopiped, the bones hard and rough. There are two distinct dorsals, and three free rays under the pectoral. They have about twelve cæca, and a broad and bilobate air-bladder. Several species, when caught, utter sounds which have procured for them in France their vulgar name of *Grondins*; in England they are called *Gurnards*.

TRIGLA, *Cuv.*

The Triglae, properly so called, have teeth dense as the pile on velvet in the jaws and before the vomer. The pectorals are large, but not sufficiently so to raise them above the water. Numerous species are found on the coast of Europe.

Tr. pini, Bl., 355; *Trig. cuculus*, L.? (The common Red Gurnard). Numerous vertical and parallel lines along each side of the body, intersecting the lateral line, and formed by folds of the skin, in each of which is a cartilaginous lamina; muzzle oblique. A well-flavoured fish of a fine red colour.

Tr. lineata, L.; *Tr. adriatica*, Gm.; Bl. 35; Rond. 295; Martens, Voy. to Venice, II, pl. ii. (The Lineated Gurnard). The muzzle much more vertical, and the pectorals longer; the lines on the flanks encircle the body like rings. It is brought to our markets with the preceding species †.

Tr. hirundo, L.; Bl., 60 ‡. (The Swallow Gurnard). Neither spines nor furrows on the sides; back brownish, sometimes reddish; pectorals one fourth of its length, the inner side edged with blue. It is the largest species taken on the coast of Europe, sometimes exceeding two feet in length.

Neighbouring species are found in India §.

Tr. lyra, L.; Bl., 350; Rond. 298. (The Lyre). The muzzle divided into two dentated lobes; a stout spine on the operculum, super-scapular, and particularly on the humeral; spines along the dorsals; lateral line smooth; pectorals one third of its length; a beautiful fish, bright red above and a silvery white beneath.

Tr. gurnardus, L.; Bl. 58. (The Grey Gurnard). A pointed spine on the shoulder and operculum; scales on the lateral line slightly carinate; generally grey-brown above, spotted with white, and white beneath; some of them, however, are reddish or red. Common in the markets in France.

* *Trigle*, the Greek name of the Mullet; Artedi united these two genera, and, since they have been separated, this name has been assigned to the Gurnards.

† It is popularly but wrongly believed to be the female of the red Gurnard.

‡ It is the *Tr. cuculus*, of Brunnich.

§ They are new; we describe them in the fourth volume of our Ichthyology.

Tr. cuculus, Bl., 59*. (The Cuckoo Gurnard). A neighbouring species which is always red with a black spot on the first dorsal.

Tr. lucerna, Brun.; Rondel. 287†. Scales on the lateral line higher than they are wide; the second dorsal spine prolonged into a filament.

Tr. aspera; Viviani; Rondel., 296. Short muzzle, rough scales, velvet head; sharp crests along the dorsals; temple emarginate.

These two last species are small, and peculiar to the Mediterranean‡.

M. de Lacépède has separated three genera from *Trigla*:

PRIONOTUS, *Lacep.*

American fishes resembling the *Tr. hirundo*. Their pectorals, however, are longer, and can support them in the air; their distinguishing character, however, consists in a band of teeth, dense as the pile on velvet, on each palatine§.

PERISTEDION, *Lacép.*

This genus has been separated from *Trigla* with still more propriety. The whole body is mailed with large hexagonal scales, forming longitudinal ridges; the muzzle is divided into two points, under which are branched cirri: no teeth.

P. cataphracta; *Trigla cataphracta*, L.; Rondel., 299. Red; a foot long; from the Mediterranean; the only species well known||.

The best of these divisions is

DACTYLOPTERUS, *Lacep.*

The Flying Gurnards, so celebrated under the name of Flying Fishes; the subpectoral rays are much more numerous and longer; and instead of being free, as in the preceding ones, they are united by a membrane so as to form a supernumerary fin, longer than the fish, which supports it in the air for some time. Thus they are seen flying above the surface of the water, in order to escape from Dolphins and other voracious fishes; they fall into it again, however, in a few seconds.

Their extremely short snout has the appearance of a hare-lip; the mouth is beneath, and the jaws are only furnished with rounded teeth, in small patches, like paved compartments; the helmet is flattened, rectangular, and rough; the preoperculum terminates in a long and stout spine, which forms a powerful weapon; all their scales are carinated.

* It is the *Tr. hirundo* of Brunnich; but it is neither the *cuculus* nor the *hirundo* of Lin.

† It is not the *Tr. lucerna* of Lin., but his *Tr. obscura*, described Mus. Ad. Fred. part II, and subsequently forgotten. The *Tr. lucerna*, L., is a factitious species.

‡ Add the neighbouring species: *Tr. papilio*, Cuv.;—*Tr. phalena*;—*Tr. sphinx*; described in our fourth volume of Ichthyology.

§ *Tr. punctata*, Bl. 353 and 354;—*Tr. strigata*, Cuv., *evolans*, L., or *lineatus*, Mitchill, New York Trans., I, pl. iv, 4;—*Tr. carolina*, L., or *palmipes*, Mitchill, I, cit. *Tr. tribulus*, Cuv.

|| The fig. of Bloch, 349, is incorrect, and gives too many rays to the second dorsal. Several other species are found in the East Indies.

D. volitans; *Trigla volitans*, L.; Bl. 351, the Mediterranean species, is a foot long; brown above; reddish beneath; fins black, variously marked with blue.

D. orientalis, Cuv. Russel, 161, is a neighbouring species from the Indian Ocean.

CEPHALACANTHES, Lacep.

Have nearly the form, and particularly the head of the Flying Gurnards; differing from them, however, in the total absence of supernumerary fins or wings.

C. spinarella; *Gasterosteus spinarella*, L.; Mus. Ad. Fred. pl. xxxii, f. 5. A very small species from Guiana, and the only one known*.

COTTUS, Lin.

The Bull-heads have the head broad, depressed, mailed, and variously armed with spines or tubercles; two dorsals; teeth placed in front of the vomer, but none on the palatines; six rays in the branchiæ, and only three or four in the ventrals. The inferior pectoral rays, as in *Trachinus*, are not branched; their cæcal appendages are small in number, and they have no natatory bladder.

Those that inhabit fresh water have a nearly smooth head, and but one spine to the preoperculum; their first dorsal is very low. The most common species is,

C. gobio, L.; Bl. 39, 1, 2. (The River Bull-head). A small blackish fish, four or five inches in length.

The salt-water species are more spinous, and when irritated their head becomes still more inflated. The French coasts have the following two, which are called Sea Scorpions, &c.

C. scorpius, L.; Bl. 40. (The Father-Lasher). Three spines on the preoperculum. *C. bubalis*, Euphrasen, New Stockh. Mem. VII, 95. Preoperculum with four spines, the first very long.

The Baltic Sea has a third species,

C. quadricornis, Bl. 108. (The Four-horned Bull-head). Distinguished by four quadrate and bony tubercles.

America and the north of the Pacific Ocean produce much larger ones†. A small species is taken in the latter, whose singularity of form entitles it to notice: it is the

C. diceraus, Pall.; *Sinanceia cervus*, Tilesius, Mém. Acad. Petersb. III, 1811, p. 278. (The Stag-horn Bull-head). Internal edge of the first spine of the preoperculum, which is nearly as long as the head, furnished with six or eight prickles recurved very properly towards its base‡. From this species has been separated,

* It is from Guiana, and not from India, as is still asserted.

† *C. virginianus*, Will. X, 15, or *octodecim spinosus*, Mitchill, New York, Trans. IV, p. 380;—*C. polyacanthocephalus*, Pall. Zool. Russ., &c.

‡ Add, *C. pistilliger*, Pall. Zool. Russ. III, 143.

N.B. The *Cottus anostomus*, Pall. Zool. Russ. III, 128, is the *Uranoscopus*.

ASPIDOPHORES, *Lacép.*—AGONUS, *Bl. Schn.*—PHALANGISTA, *Pall.*

Which have the body defended by angular plates like that of a *Peristedion*, and there are no teeth in the vomer.

A species is found on the coast of Europe, *Cott. cataphractus*, L. Bl. A small fish but a few inches long, whose mouth opens beneath, and the whole of whose branchial membrane is furnished with little fleshy filaments.

The north of the Pacific produces several others, in one of which the mouth is also beneath, and the branchial membrane villous*.

In others the lower jaw projects beyond the upper one, and the branchial membrane is smooth†.

The jaws of some are equal, and the two dorsals separated‡.

Finally, there is one in India that has but a single dorsal, *Lacép.* has formed a genus for it, which he calls *ASPIDOPHOROIDE*§.

Other groups have lately been observed, which are partly allied to *Cottus*, and partly to *Scorpena*.

HEMITRIPTERUS, *Cuv.*

Have the head depressed, and two dorsals, as in *Cottus*; no regular scales on the skin, but teeth in the palate. The head is bristly and spinous, and has several cutaneous appendages. The first dorsal is deeply emarginate, a circumstance which has led some authors to believe they had three.

But one species is known from North America, *Cottus tripterygius*, Bl. Schn.||, which is taken along with the Cod. From one to two feet long, tinged with yellow and red, varied with brown.

HEMILEPIDOTUS, *Cuv.*,

Have the head nearly similar to that of a *Cottus*, but there is only one dorsal; the palatines furnished with teeth; longitudinal bands of scales on the body, separated by others which are naked. A thick epidermis prevents these scales from being seen until the skin is dried.

The species known are from the north of the Pacific¶.

* *Phalangistes acipenserinus*, Pall., or *Ag. acip.*, Tiles.

† *Phal. loricatus*, Pall., or *Agonus dodecaedrus*, Tiles.;—*Phal. fusiformis*, Pall., or *Ag. rostratus*, Tiles.;—*Ag. levigatus*, Tiles., or *Syngnathus segaliensis*, Id. Mém. Nat. Mosc. II, xiv.

‡ *Cottus japonicus*, Pall. Spic. Zool. VII, v, or *Ag. stegophthalmus*, Til. Mem. Petersb. IV, xiii, and Voy. Krusenstern, pl. 87;—*Ag. decagonus*, Bl. Schn. pl. xxvii.

§ *Cottus monopterygius*, Bl. 178, 1 and 2.

|| It is also the *Cottus acadianus*, Penn. Arct. Zool. VIII, 371; the *Cottus hispidus*, Bl. Schn. 63; the *Scorpena flava*, Mitchell, Ann. New York Lyc. I, ii, 8; and perhaps the *Scorpena americana*, Gmel. Duhamel, Sect. V, pl. ii, f. 5; but this figure must be very incorrect.

¶ *Cottus hemilepidotus*, Tilesius, Mem. Ac. Petersb. III, pl. xi, f. 1, 2, which is probably the *Cottus trachurus*, Pall. Zool. Russ. III, 138.

PLATYCEPHALUS, *Bl.*

This genus has been separated from *Cottus* for still stronger reasons. The ventrals large, six-rayed, and placed behind the pectorals; the head is much depressed, with trenchant edges, and armed with spines, but is not tuberculous; the branchiæ have seven rays, and they are covered with scales; a range of sharp teeth in the palatines, &c. They inhabit the Indian Ocean, and bury themselves in the sand to watch for their prey.

It is on this account that one species has been called the *Insidiator*—*Cottus insidiator*, L.*

SCORPÆNA, *Lin.*

The Scorpions have the head like that of a *Cottus*, mailed and roughened, but compressed on the sides; body covered with scales; several rays in the branchiæ, and back has but a single fin. If we except the armature of the cheek, and the tubercles which frequently give them an odd appearance, they closely approximate to certain Percoides, such as the Acerinæ and the Centropriestres; but though the inferior rays of their pectorals, as in *Cottus*, are articulated, they are simple and not branched.

SCORPÆNA, *Cuv.*

The Scorpions, properly so called, have the head spinous, tuberculous, and without scales; teeth in both jaws and palatines dense as the pile on velvet; irregular cutaneous cirri on different parts of the body.

Sc. scrophæa, L.; Bl. 182; and better, Duham. sect. V, pl. iv. (The larger Sea-Scorpion). Redder; larger scales and more numerous cirri.

Sc. porcus, L.; Bl. 181, and Duham. sect. V, pl. iii, x, 2. (The Little Sea-Scorpion). Browner; scales smaller and more numerous. They live in troops among the rocks; wounds from their spines are considered very dangerous†.

The TÆNIANOTES are Scorpions with a strongly compressed body, whose very high dorsal is united to the caudal.

* It is also the *Cottus spatula*, Bl. 424, the *Cotte madegasse*, Lacép. III, ii, 12; the *Callionymus indicus*, L., Russel, 46, or *Callionymus indien*, Lacép.—Add, *Platyc. endrachtensis*, Quoy et Gaym. Voy. Freycin. p. 353;—*Cott. scaber*, L., Bl. 189, Russ. 47;—the two species or varieties of Krusenstern, pl. 59;—the *Sandkruyper* of Renard, part II, pl. 50, f. 210, and ten new species described in the fourth volume of our Ichthyology; but the *Plat. undecimalis*, Bl. Schn., is a *Centropomus*; his *Pl. saxatilis*, a *Cychla*, and his *Pl. dormitator* an *Eleotris*.

N. B. The only foundation of the genus CENTRANODON, Lacép., is the pretended *Silurus imberbis* of Houttuyn, which is a mere *Platycephalus*.

† Add, *Sc. diabolus*, Cuv., Duham. sect. V, pl. iii, f. 1;—*Sc. bufo*, Cuv., Parr. XVIII, 1, c;—*Sc. cirrhosa*, or *Perca cirrhosa*, Thunb. New Stockhol. Mém. XIV, 1793, pl. vii, f. 2;—*Sc. papillosa*, Forst., Bl. Schn. 196;—*Sc. Plumier*, Lacép. I, xix, 3;—*Sc. venosa*, Cuv. Russ. 56, and several new species described in our 4th volume of Ichthyology.

SEBASTES, Cuv.,

Possess all the characters of the Scorpions, except that there are no cutaneous cirri, and that the head is less rough and scaly.

There is a large species in the Northern Ocean, called the *Marulke*, and in some places *Carp*, the *Sebastes norvegicus*, Cuv.; *Perca marina*, Penn.; *Perca norvegica*, Mull. Bonat. Encycl. Meth. pl. Ichthy. f. 210. It is red, and frequently upwards of two feet in length. It is dried for the purpose of food, and its dorsal spines are used by the Esquimaux as needles. The Mediterranean produces another, very similar, but which has fewer dorsal rays, the *Sebastes imperialis*, Cuv.; *Scorpena dactyloptera*, Laroche, Ann. Mus. XIII, pl. xxii, f. 9. Its palate is black, and it has no natatory bladder, although the contrary is the case with the preceding species*.

PTEROIS, Cuv.,

Have the characters of the Scorpions, properly so called, except that there are no palatine teeth, and that the dorsal and pectoral rays are excessively elongated.

These fishes are from India, and were not less remarkable for this singular prolongation, than for the pretty disposition of their colours†.

BLEPSIAS,

Have the head compressed; cheeks mailed; fleshy cirri under the lower jaw; five branchial rays; ventrals very small, and one very high dorsal divided by emarginations into three parts.

The only species known are from the Aleutian islands‡.

APISTUS

Have the palatine teeth and entire dorsal of the Scorpions; but the few rays of their pectorals are all branched. Their distinguishing character consists in a stout spine on the suborbital, which, inclining from the cheeks, becomes a treacherous weapon§. They are all small.

Those of the first division have a scaly body, and some of these have a free ray under a large pectoral||; others have ordinary pectorals, without free rays¶.

* The pretended *Sc. malabarica*, Bl. Schn. 190, is a *Sebastes*, identical with the species of the Mediterranean.—Add, *Sc. capensis*, Gmel.;—*Holoc. albofasciatus*, Lacép. IV, 372;—*Perca variabilis*, Pall., or *Epinephelus ciliatus*, Tiles. Mem. Acad. Petersb. IV, 1811, pl. xvi, f. 1—6.

† *Sc. volitans*, Gm. Bl. 184;—*Sc. antanata*, Bl. 185;—*Sc. Kœnigii*, Id. New Stock. Mem. X, vii, and several new species described in our fourth volume.

‡ *Blennius villosus*, Steller, or *Trachinus cirrhosus*, Pall. Zoog. Russ. III, 237, No. 172. *Blepsias* is a name descended to us from the antients without any characteristic designation.

§ Greek, *Apistos*, *perfidus*, treacherous.

|| *Ap. aplatus*, Cuv., Russel, 160, B;—*Scorp. carinata*, Bl. Schn.

¶ *Cottus australis*, J. White, New South, IV, 266;—*Ap. tænianotus*, Cuv., Lacép.

In a second division the body is naked; some of these also have a free ray under the pectoral*, and others are without them†.

AGRIOPUS

Are deficient of the suborbital spine; the dorsal still higher than in Apistes, and reaching between the eyes; their neck is elevated, muzzle narrowed, mouth small and but slightly dentated, and the body without scales‡.

PELOR.

The Pelors, with the entire dorsal and palatine teeth of the Scorpions, have no scales on the body; they have two free rays under the pectoral; anterior part of the head flattened; eyes proximate, dorsal spines very high, and almost free; the suborbital spine of Apistes is wanting, and their fantastic shape and monstrous aspect are alone sufficient to distinguish them from all other fishes. They inhabit the Indian Ocean§.

SYNANCEIA, *Bl. Schn.*,

Have their forms not less hideous than the Pelors; their head is rough, tuberculous, uncompressed, frequently enveloped in a lax and fungous skin; their pectoral rays are all branched; their dorsals are entire, and they have no teeth, either in the vomer or palatines; their frightful appearance induces the fishermen of the Indian Ocean, which they inhabit, to consider them as venomous||.

LEPISACANTHES, *Lacep.*—MONOCENTRIS, *Bl. Schn.*,

Constitute a singular genus; the body is short, thick, and completely mailed with enormous angular, rough, and carinated scales; four or five stout free spines supply the place of the first dorsal; each ventral consists of an immense spine, in the angle of which some soft and almost imperceptible rays are concealed; head bulky and mailed; front gibbous; mouth large; teeth in the jaws and palatines like the pile on velvet, but none in the vomer; eight rays in the branchiæ. But one species is known, from the Japanese Sea,

Mon. japonica, *Bl. Schn.* pl. xxiv; *Lépisacanthé japonais*, *Lacep.*
Six inches long, of a silvery white¶.

IV, iii, 2, a figure intitled *Tanianote large raie*, but one which has nothing in common with the *T. large raie*, of the text, IV, 303 and 304, which is a *Malacanthus*, and the same that is represented, III, xxviii, 2, under the name of *Labre large raie*; —*Perca cottoides*, *L.*, *Mus. Ad. Fred.* II, p. 84.

* *Ap. minus*, *Cuv.*, *Russel*, 159;—*Sc. monodactyle*, *Bl. Schn.*

† The species are new, and described, as well as others of the preceding subdivisions, in our fourth volume of *Icthyology*.

‡ It is the *Blennius torvus* of *Gronov.* *Act. Helvet.* VII, pl. iii, copied, *Walb.* III, pl. 2, f. 1; or *Coryphæna torva*, *Bl. Schn.*, and some new species.

§ *Pel. obscurum*, *Cuv.*, or *Scorpana didactyla*, *Pall. Spic. Zool.* VII, xxvi, iv;—*Seb.* III, xxviii, 3, or *Trigla rubicunda*, *Hornstedt*, *Stockhol. Mem.* IX, iii, and some new species described in our fourth volume of *Icthyology*.

|| *Scorpana horrida*, *L.*, *Lacép.* II, xvii, 2; and not so well, *Bl.* 83;—the *Sc. brachion*, *Lacep.* III, xii, 1, or *Synanceia verrucosa*, *Bl. Schn.* pl. 45;—*Syn. bicapitata*, *Lacep.* II, xi, 3.

¶ *Gasterosteus japonicus*, *Houtt. Harl. Mem.* XX, part II, 299, or *Sciana japonica*, *Thunb.* *New Stockh. Mem.* XI, iii, copied *Bl. Schn.* pl. xxiv.

GASTEROSTEUS*, Cuv.

The Epinoches have also the cheek mailed, although the head is neither tuberculous nor spinous, as in the preceding genera. Their peculiar character is the freedom of the dorsal spines, and their not forming a fin, in their pelvis, united to the humeral bones, being larger than usual, and thus furnishing the abdomen with a sort of bony mail. Their ventrals, placed farther back than the pectorals, are nearly reduced to a single spine; there are but three rays to the branchiæ.

Some of them abound in the fresh waters of Europe.

Two species are confounded under the name of Stickleback,—*Gasterosteus aculeatus*, L. (The Banstickle), which have three free dorsal spines; but the entire side of one of them, *G. trachurus*, Cuv. Bl., pl. 53, f. 3, is covered with scaly plates to the very end of the tail. These plates are only found on the pectoral region in the other, *G. gymmurus*, Cuv. Willoughb., 341. Both these species are sometimes so abundant in certain rivers in England and the north of Europe, that they are used to manure the land, feed hogs, furnish oil, &c.†

G. pungitius, L.; Bl. 53, 4, (The Lesser Stickleback), is the smallest of the European fresh-water fishes; nine very short spines on the back; sides of the tail with carinated scales; another closely allied species inhabits the same streams, *G. lævis*, Cuv., in which this armature is wanting. A separate subgenus might be made of the

G. spinochia, L.; Bl. 53, 1, (The larger Stickleback), a salt-water species, of an elongated and slender form, with fifteen short dorsal spines, and the entire lateral line covered with carinated scales. Its abdominal shield is divided in two; and, besides the spine, there are two small rays in the ventral.

After this family we place the

OREOSOMA, Cuv.,

A small oval fish, whose whole body, above and beneath, is studded with thick cones of a horny substance, like hills. There are four of them on the back, and ten on the belly, arranged in two series, with several smaller intermediate ones. It was discovered in the Atlantic by Peron‡. The third family of the Acanthopterygians, that of

* N. B. This name, which signifies bony belly, is only applicable to the Gasterosteæ as we have defined them, and not to several of the Scomberoides, united with them by Linnæus on account of their dorsal spines being free: these latter we refer to our LICHIA.

† Neighbouring species or three-spined Sticklebacks: *G. argyropomus*, Cuv.;—*G. brachycentrus*, Cuv.;—*G. tetracanthus*, Cuv., three Italian species;—*G. noveboracensis*, Cuv.;—*G. niger*, Cuv., or *biaculeatus*, Mitchell, Ann. New York Lyc. I, 1, 10;—*G. quadratus*, Id. Ib. f. 11;—*G. cataphractus*, Tiles. Mem. Acad. Petersb. III, viii, 1.

‡ The fig. and detailed description will be found in our fourth Vol. on Ichthyology. *Oreosoma*, a mountainous body.

FAMILY III.

SCIENOIDES,

The Scienoides, has close relations to the Perches, and even present nearly similar combinations of external characters, particularly in the indentations of the preoperculum, and in the spines of the operculum; but both vomer and palatines are without teeth; the bones of the cranium and face are generally cavernous, and form a muzzle more or less gibbous. The vertical fins are frequently somewhat scaly.

Some of the Scienoides have two dorsals, and others have but one; among the former we first find the genus,

SCIÆNA,

Whose common characters consist of a gibbous head, supported by cavernous bones, two dorsals, or one deeply emarginate, whose soft part is much longer than the spinous; a short anal, a dentated preoperculum, an operculum terminating in points, and seven branchial rays. If it were not for the absence of the palatine teeth, these fishes would resemble the Perches. The entire head is scaly; their natatory bladder is frequently furnished with remarkable appendages, and the stones in the sac of the ear are larger than in most fishes*. We divide this genus as follows:

SCIÆNA, Cuv.

The Scienoides, properly so called, have the spines of the anal weak; neither canini nor cirri.

Sc. umbra, Cuv.; *Peisrey* of Languedoc; *Fegaro* of the Genoese; *Umbrina* of the Romans, &c. Six feet and more in length; numerous branched appendages on each side of the natatory bladder. A good fish, but it has latterly become rare on the coast of Europe†.

OTOLITHUS, Cuv.

The Otolithes have the anal spines, as in the preceding, weak, and no cirri; some of the teeth are elongated hooks, or true canines; the natatory bladder has a horn on each side which is directed forwards. They are found in America and India‡.

* This determination of the genus *Sciæna* is in accordance with the opinion of Artedi; it has been variously modified by Linnæus and his successors, but in our opinion not very successfully.

† Artedi having confounded it with the *Sciæna nigra*, it is only latterly that it has been again determined. See my Memoir upon this Fish in the *Mém. du Mus.*, tome I, p. 1;—Add the *Maigre du Cap*, or *Labre hololépide*, Lacép. III, xxi, 2;—the *Maiigre brûlé*, which is the *Perca ocellata*, L., or *Centropome œillé*, Lacép., the *Sciæna imberbis* of Mitchill, and the *Lutjan triangle*, Lacép. III, xxiv, 3.

‡ *Ot. ruber*, Cuv., or the *Pêche pierre* of Pondicherry; *Johnius ruber*, Bl., Schn., p. 17;—*Ot. versicolor*, Cuv., Russel, II, cix;—*Ot. regalis*, Cuv., *Johnius regalis*, Bl., Schn., or *Labrus squeteague*, Mitchill, Ann. New York Lyc. I, ii, 6;—*Ot. rhomboidalis*, or *Lutjan de Cayenne*, Lacép. IV, p. 245;—*Ot. striatus*, Cuv., or *Guatucupa*, Marcgr., Braz. 177, and several others described in our fifth Vol. of Ichthyology.

ANCYLODON.

A sort of *Otolithus* with a very short muzzle, excessively long canines, and a pointed tail*.

CORVINA, *Cuv.*

Neither canini nor cirri; all the teeth dense as the pile on velvet. They also differ from the *Sciænoides* and the *Otolithus* in the size and strength of the second anal spine. One species is very abundant in the Mediterranean.

Sc. nigra, Gm.; *Corb noir*, Bl. 297. A silvery brown; ventrals and anal black†.

JOINIUS, *Bl.*

The fishes of this subdivision are connected with those of the preceding one by a nearly uninterrupted series, the second anal spine is merely somewhat weaker and shorter than the subsequent soft rays. They are found in India, where they form a considerable article of food, their flesh is white and light‡. They are also met with in Senegal§, and in America||.

UMBRINA, *Cuv.*

Distinguished from other *Sciænoides* by a cirrus under the symphysis of the lower jaw.

A beautiful species is taken in the Mediterranean,—*Sciæna cirrhosa*, L.; Bl. 300, obliquely streaked with steel-colour on a gold ground. It is a large and good fish, which has ten short cæca, and a large natatory bladder furnished with some lateral, rounded sinuses¶.

The *Lonchurus*, Bl., merely appear to differ from the *Umbrina* in a pointed caudal and two cirri on the symphysis**. The

POGONIAS, *Lacép.*

Resemble the *Umbrina*, but, instead of a single cirrus beneath the jaw, there are several.

* *Lonchurus ancyodon*, Bl., Schn., pl. XXV.

† Add, *Corv. miles*, Cuv., or *Tella katchelee*, Russ. 117;—*C. trispinosa*, Cuv., or *Bodianus stellifer*, Bl. 331, 1;—*C. ozula*, Lesueur, Ac. Nat. Se. Phil. Nov. 1822;—*Bola cuja*, Buchan., Fishes of the Ganges, pl. xii, f. 27;—*C. furcraa*, Cuv., Lacép. IV, p. 424; and *Bola coitor*, Buchan. XXVII, 24; *Bodianus argyroleucus*, Mitch. Ann. New York Lyc. I, vi, 3.

‡ The English of Bengal call it the *Whiting*.—*John. maculatus*, Bl., or *sarikulla*, Russ. 123;—*J. cataleus*, Cuv., Russ. 116, or *Bola chaptis*, Buchan. X, 25. It is the *Lutjan diacanthæ*, Lacép. IV, 244;—*J. anei*, Bl. 357;—*J. karutta*, Bl.;—*J. pama*, Cuv., Buchan. XXXII, 26.

§ *J. senegalensis*, Cuv., spec. nov.

|| *J. humeralis*, Cuv., or *Labrus obliquus*, Mitchill, which also appears to be the *Perca undulata*, L.;—*J. Xanthurus*, or *Leiostome, queue jaune*, Lacép. IV, x, 1;—*J. saratilis*, Bl., Schn.

¶ The *Cheilodiptère cyanoptère*, Lacép. III, xvi, 3, is merely a rudely drawn *Umbrina*. Add, *Omb. Russelii*, Cuv., Russel, 118;—*Sc. nebulosa*, Mitch. III, 5, which is also the *Perca alburnus*, L., Catesb. XII, 2;—*Kingfish* or *Whiting* of the United States;—the *Pogonathe doré*, Lacép. V, 122, also belongs to this subgenus.

** *Lonchurus barbatus*, Bl. 360.

One of them is found in America,—*Pog. fascé*, Lacép. II, xvi*, of a silver colour, when young marked with vertical brown bands, which becomes as large as the *Sc. umbra*, and, like it, has branched appendages to the natatory bladder†. This fish produces a sound still more remarkable than any of the other Scienoides, which has been compared to that of several drums. Its pharyngeal bones are furnished with large teeth as if paved‡.

EQUES, Bl.

This genus cannot be removed from these Scienoides with two dorsals. It is known by the compressed and elongated body, raised at the shoulders and ending in a point near the tail; teeth small and crowded; the first dorsal is elevated, the second, long and scaly; they all belong to America§.

The Scienoides, with a single dorsal, are subdivided according to the number of their branchial rays.

Those which have seven rays form various genera parallel to several genera of the Perches; their preoperculum is always dentated.

HÆMULON, Cuv.

A somewhat elongated profile, which has been thought to bear some resemblance to that of a hog; the lower jaw compressed and opening very wide; two pores and a little oval cavity under its symphysis; teeth small and dense as the pile on velvet. The parts of the lower jaw which enter the mouth when it is closed, are generally of a vivid red, from which circumstance their name is derived||. Their dorsal is slightly emarginate, and its soft part scaly; they are all from America¶.

PRISTIPOMA, Cuv.

Have the same preoperculum, and the same kind of pores under the

* *Lonchurus barbatus*, Bl. 360.

† It is the *Labrus grunniens*, Mitch. III, 3; the *Sciæna fusca* and *gigas*, Id., appear to be the same species at a more advanced age, and every thing proves it to be also the *Labrus chromis*, L.; finally, the *Pogonathe courbine*, Lacép. V, 121, is the same. Add, *Ombrina Fournieri*, Desmar., Dict. Class. d'Hist. Nat.; its cirri are almost imperceptible.

‡ They are figured by Ant. de Jussieu, Mém. de l'Ac. des Sc. 1723, pl. xi.

§ *Eques balteatus*, Cuv., or *Eq. americanus*, Bl. 347, 1, or *Chatodon lanceolatus*, L., Edw., 210;—*Eq. punctatus*, Bl., Schn., III, 2; *Eq. acuminatus*, Cuv., *Grammistes acuminatus*, Bl., Schn., Seb., III, xxvii, 33.

|| From the Greek *aima*, blood, and *ulon*, gum.

¶ *Hæm. elegans*, Cuv. or *Anthias formosus*, Bl. 323;—*Hæm. formosum*, Cuv., or *Perca formosa*, L., which is not the same as the preceding one, Catesb., II, vi, 1; but it is the *Labre Plumérien*, Lacép., III, ii, 2; and the *Guaibi coara* of Marcgr., p. 163, the fig. of which is transferred to the *capeuna*, p. 185;—*Hæm. heterodon*, or *Diabase rayée*, Desmar., Dict. Class. d'Hist. Nat.;—*Hæm. caudimacula*, Cuv., or *Uri-baco*, Marcgr., 177; and *Diabase de Parra*, Desm., loc. cit.;—*Hæm. capeuna*, or *Capeuna*, Marcgr., 155, and the fig., p. 163, of the *Guaibi coara*. It is the *Grammist. trivittatus*, Bl., Schn., 188;—*Hæm. chrysopteron*, Cuv., or *Perca chrysoptera*, L., Catesb., II, ii, 1, and several other species described in our fifth vol. of Ichthyology.

symphysis as in *Hæmulon*, but the muzzle is more gibbous, the mouth not so deeply cleft, and the dorsal and anal are without scales. The operculum terminates in an obtuse angle concealed in its membranous edge. It is a very numerous genus, whose species are found throughout the hot parts of both oceans*.

DIAGRAMMA, Cuv.

The cavity beneath the symphysis wanting, but the two small anterior pores still remain; besides which, there are two larger ones beneath each branch. In every thing else, the jaws, opercula and fins are like those of *Pristipoma*. They are found in both oceans: those of the Atlantic have the largest scales†.

Those of India are the most numerous and have smaller scales, a more convex front and a very short muzzle‡.

The *Scienoides* with a single dorsal and less than seven branchial rays, are still more subdivided: in some of them the lateral line extends to the caudal; in others it is interrupted. Among the former we place the following genera:

LOBOTES, Cuv.

A short muzzle; lower jaw prominent; body elevated; the posterior angle of its dorsal and anal so elongated, that, with the rounded caudal, it appears to terminate in three lobes. Four groups of extremely small points are visible near the end of the jaw; they inhabit both oceans§.

CHEILODACTYLUS, Lacép.

Have the body oblong; mouth small; numerous spiny rays in the dorsal; inferior rays of the pectorals simple and continued beyond the membrane, as in the *Chirrhites*||.

* *Pr. hasta*, Cuv., *Lutjanus hasta*, Bl., 246, 1;—*Pr. nageb.*, Cuv.; *Sciæna nageb.*, Forsk., or *Labre Comersonien*, Lacép., III, xxiii, 1; and *Lutjan microstome*, Ib. XXXIV, 2;—*Pr. guoraca*, Cuv., Russel, 132, or *Perca grunniens*, Forsk., or *Anthias grunniens*, Bl., Schn., p. 305;—*Pr. Paikelli*, Cuv., Russel, 121;—*Pr. caripa*, Id., 124, of which the *Anth. maculatus*, Bl., 326, 2, appears to be a variety;—*Pr. coro*, Cuv., Seb., III, xxvii, 14, or *Sciæna coro*, Bl., 307, 2;—*Lutj. surinamensis*, Bl., 253;—*Sparus virginicus*, L., of which *Perca juba*, Bl. 308, 2; and *Sparus vittatus*, Bl., 263, are the young;—*Coius nandus*, Buchan, XXX, 32.

† We know but one of them, of which the *Lutjanus luteus*, Bl. 247, appears to be a bad figure.

‡ It is to them that the *PLECTORYNQUE*, Lacép., I, xiii, 2, must be referred. Add the *Sciæna gaterina*, Forsk.;—*Sc. shotaf*, Id.;—*Diagr. lineatum*, Cuv., or *Perca diagramma*, L., Seb., III, xxvii, 18, or *Anthias diagramma*, Bl., 320;—*Diag. pæcilopterum*, Cuv., Seb., III, xxvii, 17;—*D. pictum*, Cuv., Seb., III, xxvi, 32, or *Perca picta*, Thunb. New Stockh. Mem., XIII, v;—*D. pertusum*, or *Perca pertusa*, Id., Ib., XIV, vii, 1.

§ *Holocentrus surinamensis*, Bl., 243, or *Bodianus triurus*, Mitch. III. f. 10, and new species.

|| The *Cheilod. fuscé*, Lacép., V. i, 1, or *Cynædus*, Gronov., Zoophyl., I, x, 1;—the *Cheil. of Carmichael*, or *Chatodon monodactylus*, Id., Lin. Trans. XII, xxiv;—*Cheil. carponemus*, Cuv., or *Cichla macroptera*, Bl., Schn., 342;—*Cheil. zonatus*, Cuv., or *Labrus japonicus*, Tiles., Voy. Krusenst. pl. lxiii, f. 1.

SCOLOPSIDES, *Cuv.*

Have the second infra-orbital dentated and terminating near the edge of the orbit in a point directed backwards, which crosses another point of the third infra-orbital running in a contrary direction. The body is oblong, the mouth but slightly cleft, the teeth small and dense as the pile on velvet, and the scales large. There are no pores in the jaws. From the Indian Ocean*.

MICROPTERUS, *Lacép.*

Have the body oblong; three pores on each side of the symphysis; the last rays of the soft part of the dorsal separated from the others, and forming a small particular fin; operculum without dentation†.

Those Scienoides which have less than seven branchial rays and an interrupted lateral line, form several genera of small, oval fishes, prettily diversified in their colours, which may be distinguished as follows by the armature of their head. They are manifestly related to the genus *Chætodon*, and resemble, externally, several of our fishes with labyrinthian branchiæ.

AMPHIPRION†, *Bl. Schn.*

Have the preoperculum and the three opercular pieces dentated, the latter even furrowed; a single range of obtuse teeth§.

PREMNAS, *Cuv.*

Have one or two stout spines on the infra-orbital, and the preoperculum dentated||.

POMACENTRUS¶, *Lacép.*

Preoperculum dentated, operculum unarmed; a single range of trenchant teeth**.

* *Scol. kate*, *Cuv.*, named by Bloch *Anthias japonicus*, 325, f. 2;—*Anth. Vosmeri*, *Bl.*, 321, a poor figure, and the same as the *Perca aurata*, Mungo Park, *Lin. Trans.* III, 35;—*Anth. bilineatus*, *Bl.* 325, 1;—*Scol. kuriata*, *Cuv. Russel.* 106;—*Scol. lycogenis*, *Cuv.*, or *Holoc. cilié*, *Lacép.* IV, 371;—*Sciæna ghanam*, *Forsk.*, and several new species.

† But one species is known, the *Microptère Dolomieu*, *Lacép.*, IV, iii, 3. We have also some few more subgenera of this subdivision, which we shall speak of in our 5th vol. of *Ichthyology*.

‡ I greatly reduce the number of species of this genus, as composed by Bloch.

§ *Amph. ephippium*, *Bl.*, 250, 2;—*Amph. bifasciatus*, *Bl.*, 316, 2;—*Amph. polymnus*, *Bl.*, 316, 1;—*percula*, *Cuv.*, or *Lutj. perchot*, *Lacép.*, IV, 239, *Klein. Misc.*, IV, xi, 8;—*Amph. leucurus*, *Cuv.*, *Renard*, VI, 49, and various new species.

|| *Chatodon biaculeatus*, *Bl.*, 219, 2, which is also the *Helocentre Sonnerat*, *Lacép.*, IV, 591; and the *Lutj. trifasciatus*, *Bl.*, *Schn.*, 567; and *Kæhlreuter*, *Nov. Com. Petrop.*, X, viii, 6; *Seb.*, III, xxvi, 29, is a variety of it;—*Pr. Unicolor*, *Cuv.*, *Seb.* III, xxvi, 19, which is also the *Scorpène aiguillonée*, *Lacép.* III, 268.

¶ We define them differently from *Lacépède*, and greatly diminish their number by divisions.

** *Chatodon pavo*, *Bl.*, 198, 1, which is the *Pomacentre paon*, *Lacép.*, and his *Holoc. diacanthæ*, IV, 338;—*Pomacentrus cæruleus*, *Quoy et Gaym.*, *Voy. Freycin.*, pl. 64, f. 2;—*P. punctatus*, *Ib.*, 1;—*P. emarginatus*, *Seb.* III, xxvi, 26, 27, 28;—the *Hol. negrillon*, *Lacép.* IV, 367.

DASCYLLUS, Cuv.

The fishes of this genus only differ from those of the preceding one in their teeth, which are very short and dense as the pile on velvet*. They all inhabit the Indian Ocean.

GLYPHISODON, Lacép.

Have the operculum and preoperculum entire; a single range of trenchant and generally emarginated teeth.

They are found in the Atlantic†, but the Indian Ocean produces many more‡.

Some of them are distinguished from the others by numerous spines in the anal§.

HELIASUS.

Have the opercular pieces of the Glyphisodon and teeth similiar to those of a Dascyllus, that is, small and dense as the pile on velvet. They are found in both oceans||.

FAMILY IV.

SPAROIDES.

The Sparoides, like the Scienoides, have a palate destitute of teeth. Their general figure and several details of their organization are the same; they are also covered with scales more or less large, but they have none on the fins. Their muzzle is not gibbous, nor the bones of their head cavernous; there are neither indentations in their preoperculum, nor spines on their operculum; their pylorus is furnished with cæcal appendages. They never have more than six rays in the branchiæ. They are divided according to the form of their teeth.

The first tribe, that of SPARUS, properly so called, Cuv., have the sides of the jaws furnished with round molars in the form of pavement; we subdivide it into five genera.

* *Chætodon aruanus*, L., Mus. Ad. Fred. XXXII, Bl., pl. 193, f. 2.

† The *Jacaraqua*, Marcgr., or *Chætod. saxatilis*, L., Mus. Ad. Fred., XXVII, 3, which is also the *Chæt. marginatus*, Bl., 287; and his *Ch. mauritii*, 213, 1; and the *Ch. sargoïde*, Lac.; but it is not the *Ch. saxatilis*, Bl., 206, 2;—*Ch. curassao*, Bl., 212.

‡ *Chætod. bengalensis*, Bl. 213, 2, or *Labre macrogastère*, Lacép., III, xix, 3;—*Gl. melanurus*, Cuv., or *Labre 6-bandes*, Lacép., III, xix, 2;—*Chæt. sordidus*, Forsk., or *Calamoia pota*, Russel., 85;—*Gl. sparoides*, Cuv., Lacép., IV, ii, 1;—*Gl. lachrymatus*, Cuv., Quoy et Gaym., Freycin., pl. 62, f. 7;—*Gl. azureus*, Ib., pl. 64, f. 3;—*Gl. unio-cellatus*, Ib., f. 4.

§ *Chætod. suratensis*, Bl. 217;—*Chætod. maculatus*, Bl., 427.

|| The species are new; we describe them in our 5th vol. of *Icthyology*.

SARGUS, Cuv.

Trenchant incisors in front of the jaws almost similar to those of Man.

Several of them which differ but little from each other inhabit the Mediterranean, and are even found in the gulf of Gascony. Their colours consist of vertical black bands on a silver ground*.

Some have emarginated incisors†.

The round molars of others are on a single line and very small. From the Mediterranean‡.

CHRYSOPHRIS, Cuv.

Have round molars on the sides of the jaw, forming at least three rows on the upper one; a few conical or blunt teeth in front. Two species inhabit the European seas.

Chr. auratus; *Sparus aurata*, L. Bl., 266§, and much better, Duham. Sect. IV, pl. 2. Four rows of teeth above; five below, one of which is oval and much larger than the others: a large and excellent fish called *Chrysophris*—golden eye-brow—by the ancients, on account of a crescent-shaped band of a golden hue which extends from one eye to the other.

Chr. microdon, Cuv. Colours nearly the same as in the *aurata*; smaller; the forehead more gibbous; only two rows of molars below, all of which are as broad as they are long, or broader; the large oval one is wanting||.

PAGRUS.

The Pagres differ from the *Chrysophris* in having but two rows of small rounded molar teeth in each jaw; the front teeth either resemble those of a card, or are small and crowded.

Pagr. vulgaris; *Sparus pagrus*, L. and Arted. Silvery, with a reddish gloss; no black spot. The Mediterranean**.

* The *Sargue de Rondelet* (*Sargus raucus*, Geoff.), Eg. Poiss. pl. xviii, 1, Rondelet, 122;—*Sp. pantazzo* of Risso;—the *Sargue de Salviani* (*Sargus vulgaris*, G.), Eg. XVIII, 2; *Salviani*, fol. 179, Pisc. 64;—the *Sparailon* (*Sargus annularis*, L.), Rondel. 118; *Salv.* 63; *Laroche*, Ann. Mus. XIII, pl. xxiv, f. 13;—*Sp. ovis*, Mitch., or *Sheephead* of the United States.

† *Perca unimaculata*, Bl. 308, 1, or *Salema*, Marcgr. 153;—*Sparus crenidens*, Forsk., probably belongs to this subdivision.

‡ *S. pantazzo*, Gm., or *Sp. acutirostris*, *Laroche*, Ann. Mus. XIII, xxiv, 12, of which Risso makes his genus *CHARAX*.

§ The teeth belong to another species, and those of the true *Chr. aurata* are figured pl. 74, as appertaining to the *Anarrhichas*.

|| Add: *Sparus byfonites*, Lacép. IV, xxvi, 2, the same as his *Sp. perroquet*, Ib. 3; and perhaps as the *Sp. haffara*, Forsk. 33;—*Sp. sarba*, Forsk. 22;—*Chr. chrysargyra*, Cuv., *Chitchillée*, Russel, 91;—*Sp. hasta*, Bl. Schn. 275, or *Sp. berda*, Forsk. 33;—*Sp. calamara*, Cuv. Russ. 92;—*Sciæna grandoculis*, Forsk. 53;—*Chatodon bifasciatus*, Forsk., which is also the *Labre chapelet*, Lacép. III, iii, 3, his *Spare mylio*, Ib. XXVI, 2, and his *Holocentre rabagi*, IV, Suppl. 725, &c.

** It is also the *Sp. pagrus* of Brunnich, but not that of Bloch; the latter has not figured the true *Pagrus*, which is the *Sp. argenteus* of his posthumous "System."

The Indian Ocean and the coast of the United States produce some of these fishes, whose first dorsal spines are prolonged into filaments*.

Others taken at the Antilles are remarkable for the first interspinal of their anal fin, which is hollow and terminates in a beak like a pen; the point of the natatory bladder runs into this kind of funnel. They are called *Särdes à plumes*†.

A more remarkable peculiarity is that of a Cape Pagrus, whose maxillaries are enlarged and as solid as stone. We call it *Pagrus lithognathus*.

PAGELUS, Cuv.

The Pagels have teeth very like those of the preceding genus; but the molars, also in two rows, are smaller; the front conical ones are slender and more numerous. A more elongated muzzle gives a very different physiognomy to this genus. Several species are found in the European seas.

Pag. erythrinus; *Sparus erythrinus*, L.; Bl. 274. A fine fish, of a silver colour, with a pale rose gloss; body high and compressed.

Pag. centrodonatus; *Sp. centrodonat.*, Laroche; the *Rousseau* of the Marseillais; the *Besugo* of the Spaniards; Ann. Mus. XIII, xxiii, 2. Silvery, glossed with rose; a large, irregular black spot on the shoulder‡.

Pag. acarne, Cuv., the *Acarne*, Rondel. 511; *Sparus berda* of Risso, but not of Forskhal. Smaller and more oblong; silvery, tinged with greenish towards the back; no black spot.

Pag. bogaraveo; *Sp. bogar.*, Gm.; Rondel. 137. (The Bogueravel). More oblong; muzzle more pointed; gilt tinged with violet; a black spot on the axilla.

Pag. mormyrus; *Sp. mormyrus*, L.; Rondel. 153; Geoff. Eg. Poiss. pl. xviii, 3. Vertical black bands on a silver ground.

In the second tribe there is but one genus,

DENTEX, Cuv.

Characterized by conical teeth even on the sides of the jaws, generally in one range, some of the anterior of which are drawn out into large hooks. They would be rather closely allied to the genus *Hæmulon* were it not that the indentation of the preoperculum is wanting, and that they have one ray less in their branchiæ. The cheek is scaly. Two species are found in the Mediterranean.

D. vulgaris; *Sparus dentex*, L.; *Dentale* of the Italians, Bl. 268. Silvery, shaded with bluish, towards the back; sometimes three feet in length§.

* *Sparus spinifer*, Forsk.;—*Sp. argyrops*, L., or *Labrus versicolor*, Mitch.

† *Pagr. calamus* and *Pagr. penna*, Cuv.

‡ It is the *Sparus pagrus*, Bl., pl. 262.

§ Add, *D. macrocephalus*, Cuv., or *Labre macrocephale*, Lacép. III, xxvi, 1;—*Sparus cynodon*, Bl. 278;—*Dentex hexodon*, Quoy et Gaym. Voy. Freycin. 301.

D. macrophthalmus; *Sp. macrophth.*, Bl. 272. Red, with very large eyes; much rarer than the preceding, and about half its size.

We distinguish from the other species of *Dentex*, by the name of *PEN-
TAPODA*, those whose mouth is less cleft, head more scaly, body less elevated, and whose caudal is covered with scales to the end*.

By that of *LETHRINUS*, we distinguish such as have no scales on the cheek; most of them, as in *Hæmulon*, have some red about the angle of the jaws†. All these fishes have a pointed scale between the ventrals, and one above each of them.

A third tribe is also composed of a single genus,

CANTHARUS, Cuv.

Teeth short and dense as the pile on velvet, or bent and crowded like cards all round the jaws; those of the external row being the strongest; body elevated and thick; muzzle short; jaws not protractile. Two species are found in the Atlantic and Mediterranean.

Canth. vulgaris; *Sparus canth.*, L.; Rond. 120, and Duham., sect. iv, pl. iv, f. 1. Silver-grey, longitudinally striped with brown; some small rough teeth behind the bent ones.

Canth. brama; *Sparus brama*, L. About the same colour; all the teeth bent‡.

In a fourth tribe the teeth are trenchant. It comprises two genera,

BOOPS, Cuv.

Teeth of the external row trenchant, mouth small and not at all protractile. Several species are found in the Mediterranean.

B. vulgaris; *Sparus boops*, L.; Rond. 136; *La bogue vulgaire*. Twenty-four teeth in each jaw, with an oblique, cutting edge; the body oblong, with longitudinal gold-coloured stripes on a silver ground.

B. salpa; *Sparus salpa*, L.; Bl. 265; *La Saupe*. More oval; stripes of a more brilliant gold, on a ground of burnished steel; teeth broad and emarginated.

OBLADA, Cuv.

Differ from Boops in having small crowded teeth behind the incisors, which somewhat approximates this genus to *Cantharus*.

Ob. melanurus; *Sparus melanurus*, L.; Sål. 181. Silvery, striped with blackish; a broad black spot on each side of the tail.

* *Sparus vittatus*, Bl. 275;—the *Sp. rayé d'or*, Lacép. IV, 131, and some new species.

† *Spar. chærorhynchus*, Bl., Schn. 278;—*Bodian lutjan*, Lacép. IV, 294;—*Kurwa*, Russel, 89;—*Sciæna mahsena*, Forsk., p. 52, No. 62;—*Sciæna harak*, Id.

‡ The fig. of Bloch, 269 and 270, intended to represent these two species, convey no correct idea of them.

We are able to form a fifth family of Acanthopterygians,

FAMILY V.

MENIDES,

The Menoid Fish, which differ from the preceding families in the extreme extensibility and retractibility of their upper jaw, which is owing to the length of the intermaxillary pedicles which withdraw between the orbits. Their body is scaly, as in *Sparus*, in which genus they have hitherto been placed.

MÆNA, Cuv.

The Mendoles are distinguished from a true *Sparus* by having their teeth dense as the pile on velvet, in a narrow and longitudinal band on the vomer. Those also in the jaws are all extremely fine, forming a very narrow band. The body is oblong, compressed, and somewhat similar to that of a Herring; an elongated scale above each of the ventrals, and another between them. Several species inhabit the Mediterranean.

M. vulgaris; *Sparus mæna*, L.; Bl. 270. (The Common Mendole). Back lead colour; belly silvery; a black spot on the flank opposite the last spine of the dorsal.

M. jusculum, Cuv. (The Juscle), only differs from the common one in having a narrower body, a shorter muzzle, and a higher dorsal.

M. radiata; *Sparus radiatus*, Osbeck; *Sp. tricuspidatus*, Spinola; Ann. Mus. X, pl. xviii. (Osbeck's Mendole). A deep steel-blue; oblique blue streaks on the cheek; blue spots on the ventrals; the dorsal still higher.

SMARIS, Cuv.

The Picarels do not absolutely differ from the Mendoles, except in the total deficiency of teeth in the vomer; their body is generally somewhat less elevated. Some of them are found in the Mediterranean.

S. vulgaris; *Sparus smarís*, L.; *Le Picarel commun*, Laroche, Ann. Mus. XIII, pl. xxv, f. 17. (The Common Picarel). Lead-grey above; silvery beneath; a black spot on the flank.

S. alcedo, Riss., so called from the beautiful blue with which its body is variegated.

S. cagarella, Cuv. (The Cagarel Picarel). The body as high as that of the *Mæna vulgaris*, from which it only differs in having no palatine teeth.

CÆSIO, Lacép.

Only differs from *Smaris* in a dorsal somewhat higher in front, and surrounded at its base with fine scales. They inhabit the Indian Ocean, and are shaped so as nearly to resemble a spindle*.

* *Cæsius asuror*, Lacép. III, 86, or *Vackum*, Valent. 132, or *Canthère douteux*, Dict. Class. d'Hist. Nat. livr. IV;—*C. smarís*, Cuv., or *Vackum mare*, Renard, I, pl. 32,

GERRES, Cuv.—MOCHARRA, in *South America*,

Also have the mouth protractile, but, in extending itself, it descends; their body is elevated, the anterior part of the dorsal in particular, along the base of whose posterior portion is a scaly sheath. They have no other teeth than those in the jaws, which are small and crowded. The first interspinal of their anal fin is tabular as in certain Pagri. They are excellent food, and inhabit the hot parts of both oceans*.

G. rhombeus, Cuv.; Sloane, II, pl. 253, f. 1, (The Rock Barbs of Jamaica), a species that is said to penetrate occasionally as far as the coast of Cornwall, following pieces of wood covered with *Anatifæ*, carried there by the currents†

The sixth family of the Acanthopterygians, or

FAMILY VI.

SQUAMIPENNES,

Is so called, because the soft, and frequently the spinous parts of their dorsal and anal fins are covered with scales, which encrust them, as it were, and render it difficult to distinguish them from the mass of the body. This is the most remarkable character of these fishes, the body of which is generally much compressed, the intestines long, and the cæca numerous. They were comprised by Linnaeus in the genus

CHÆTODON, *Lin.*

The Chætodons, so named from their teeth, which in length and tenuity resemble bristles, collected in several close rows like the hairs of a brush. Their mouth is small; their dorsal and anal fins are so completely covered with scales similar to those on the back, that it is extremely difficult to ascertain where they commence. These fishes, very abundant in the seas of hot climates, are adorned with the most beautiful colours, a circumstance which has led to the collection of them in museums, and to numerous graphic representations of the species. Their intestines are long and ample, and their cæca long, slender, and numerous; their natatory bladder is large and very strong. They frequent rocky shores, and their flesh is good for eating.

f. 174;—*Bodianus argenteus*, Bl. 231, or *Picarel raillard*, Quoy et Gaym. Zool. Freycin., pl. 44, f. 3;—*Sparus cuning*, Bl. 263, or *Cychla cuning*, Bl. Schn., p. 336. M. de Lacépède also makes a *Cæcio* of the *Scomber. equula* of Forskhal, or *Centrogaster equula* of Gmelin, which is our *Equula caballa*.

* *Labrus oyena*, Forsk. Rupp. Voy. Poiss., pl. III, x, 2, or *Spare breton*, Lacép. IV, 134, or *Labre long museau*, Id. III, xix, 1, and p. 467;—*Gerres aprion*, Cuv., Catesb. II, xi, 2;—*G. rhombeus*, Cuv., or *Stone-bass*, Sloane, Jam. II, pl. 253, f. 1;—*G. poieti*, Cuv., Ren., pl. ii, f. 9, Valent., No. 354;—*G. lineatus*, Cuv., or *Smaris lineatus*, Humb. Zool. Obs. pl. xlvii, f. 2;—*Gerres argyreus*, Cuv., or *Sciæna argyrea*, Forster, or *Cychla argyrea*, Bl. Schn.;—*G. filamentosus*, Cuv., or *Wordawahah*, Russ., f. 68.

† Couch, Lin. Trans. XIV, part I, p. 81.

THE CHÆTODONS, *properly so called*,

Have the body more or less elliptical; the spinous and soft rays continuing in a pretty uniform curve; the snout projecting more or less, and sometimes a very small indentation in the preoperculum. They have a mutual resemblance in some respects, as in the distribution of colours, and most of them, for instance, are marked with a vertical black band, in which is placed the eye.

In some there are several other vertical bands parallel to the former*. In others they are oblique or longitudinal†.

The flanks of some are sprinkled with brown spots‡.

Others again are merely marked with lines of reflections in various directions; in this it is merely the ocular band§; and in that, in addition, are ribbands on the vertical fins||.

One or two ocellated spots are observed in some¶.

Some of these Chætodons, properly so styled, are distinguished from the others by a filament formed by the prolongation of one, or several of the soft rays of the dorsal**.

Finally, some are remarkable for the very small number of the spines of their dorsals†† (a).

CHELMON, *Cuv.*

Separated from Chætodon on account of the extraordinary form of the snout, which is long and slender, only open at the extremity, and formed by a most excessive prolongation of the intermaxillary and lower jaw. Their teeth are very fine, and dense as the pile on velvet, rather than like hairs.

One species, *Chæt. rostratus*, L., Bl. 202, has the faculty of spurting drops of water on the insects it perceives on the shore, and

* *Chæt. striatus*, L., Bl. 205, f. 1;—*Ch. octofasciatus*, Gm., Bl. 215;—*H. collare*, Bl. 216.

† *Chæt. Meyeri*, Bl., Schn., improperly called *Holocanthe jaune et noir* by Lacép. IV, xiii, 2.

‡ *Chæt. miliaris*, Cuv. Zool. Voy. Freycin., pl. 62, f. 5.

§ *Chæt. Kleinii*, Bl. 218, 2;—*Ch. Schæ*, Cuv., Seb. III, xxvi, 36.

|| *Chæt. vittatus*, Bl., Schn., Seb. III, xxix, 18;—*Ch. vagabundus*, Bl. 204;—*Ch. decussatus*, Cuv., Russ. 83; and Klein, Misc. IV, ix, 2;—*Ch. bifascialis*, Cuv., Voy. de Freycin., pl. 62, f. 5;—*Ch. strigangulus*, Gm.;—*Ch. baronessa*, Cuv., Renard, I, xliii, 218;—*Ch. frontalis*, Cuv., or *Pomacentre croissant*, Lacép.;—*Ch. fasciatus*, Forsk., or *Ch. flavus*, Bl., Schn., No. 37.

¶ *Ch. nesogallicus*, Cuv., Ren. I, v, 37; and Will. App. V, 4;—*Ch. capistratus*, L., Seb. III, xxv, 16, Mus. ad Fred. XXXIII, 4;—Klein. Misc. IV, xi, 5;—*Ch. bimaculatus*, Bl. 219, 1;—*Ch. plebeius*, Gm.;—*Ch. unimaculatus*, Bl. 201, 1;—*Ch. sebanus*, Cuv., Seb. III, xxv, 11;—*Ch. ocellatus*, Bl. 211, 2.

** *Chæt. setifer*, Bl. 426, 1;—*Ch. auriga*, Forsk.;—*Ch. principalis*, Cuv. Ren., part II, lvi. 239, Valent., No. 407.

†† These species are new, as well as many others which belong to preceding subdivisions—they will be described in our Ichthyology.

⚡ (a) Freycinet relates, in his Voyage round the World, that in wading through the coral reefs at the island of Guam, in search of Mollusca, he was assailed by a very small Chætodon, not bigger than his hand: the animal butted the hand, and obstinately resisted every attempt to drive it away. The Naturalists, from this circumstance, gave it the name of *Ch. bellicosus*.—ENG. ED.

thus bringing them within reach. It is a common pastime of the Chinese at Java*.

HENIOCHUS, Cuv.,

The Coachmen, differ from the true *Chætodons*, because the first spines of the back, and particularly the third or fourth, rapidly increase in length, forming a filament sometimes double the length of the body, and resembling a kind of whip†.

EPHIPPUS, Cuv.,

The Horsemen, are distinguished by a dorsal deeply emarginated between its spinous and soft portions; the spinous part, which has no scales, can be folded into a groove formed by the scales of the back.

In one of the subdivisions there are three spines in the anal fin, and oval pectorals.

America produces a species (*Eph. gigas*, Cuv.) remarkable for the very great enlargement into the shape of a club of the first inter-spinal of its dorsal and anal fins, and by a similar enlargement of the crest of the cranium‡.

In a second subdivision from the Indian Ocean, there are three spines in the anal, and long and pointed pectorals§.

A third, also from the Indian Ocean, has four anal spines, and very small scales.

One species, *Chætodon argus*, L., Bl. 204, 1, has the reputation of feeding, by preference, upon human excrements||.

Another species of this same subdivision has been discovered in a fossil state in Mount Bolca¶.

The TAURICHTES are the *Horsemen* of India, which have an arcuated and pointed horn over each eye**.

HOLACANTHUS, Lacép.,

Have for their distinguishing character a large spine at the angle of the preoperculum, and the edges of the same bone, in most species, dentated. Their flesh is excellent, and they are remarkable for the beauty of their colours, and the regularity with which they are distributed. Numerous

* Schlosser, Trans. Phil. 1767, p. 39.—Add, *Ch. longirostris*, Brousson, Dec. Ichtyol.

† *Chætodon macrolepidotus*, L., Bl. 200, 1;—the *Chæt. acuminatus*, L., Mus. Ad. Fred. XXXIII, f. 2, appears to be a mere individual variety of it;—the *Chæt. cornutus*, L., Bl. 200, 2, of which the *Chæt. canescens*, L., Seb. III, xxv, 7, is only a young uncoloured specimen.

‡ Add, *Chætodon faber*, Brousson, pl. 212, 2, of which the *Chæt. Plumieri*, Id. 211, 1, may be a variety;—*Chæt. orbis*, Bl. 202, 2.

§ *Chæt. punctatus*, L., or *Latté*, Russ. 79;—*Chæt. longimanus*, Bl. Schn., Russ. 80;—*Eph. terla*, Cuv., Russel, 81.

¶ Add, *Chæt. tetracanthus*, Lacép. III, xxv, 2.

¶ Ittiolitologia Veronese, pl. v, f. 2, where it is figured as the *Argus*, but it is a different species.

** The *Buffalo-fish* of the Malays, *Taurichtys varius*, Cuv., well figured by Ren. I, xxx, 164, Valent. No. 71;—*T. viridis*, Ren. II, x, 49, Valent. No. 161.

species abound in both oceans*. Their form is oval or oblong; we may separate from them the

POMACANTHUS, Cuv.,

In which the form is more elevated; a circumstance resulting from the more sudden rise of the edge of the dorsal†. The only species known are from America.

PLATAX

Have in front of their brush-like teeth a row of trenchant ones, each divided into three points; the body, strongly compressed, seems to be continued into thick, vertical, elevated, and scaly fins, in whose anterior edge some few spines are concealed, so that the whole fish is much higher than it is long; very long ventrals. The whole of the subgenus are found in the Indian Ocean‡.

One species, *Ch. arthriticus*, Bell. Phil. Trans. 1793, pl. vi, of a more orbicular form, is remarkable for the knots or enlargements in some of its interspinals and spinous apophyses§.

A fossil species of this subdivision has also been discovered at Mount Bolca||.

PSETTUS, Commers.,

Have, with the figure somewhat resembling that of a Platax, the teeth small and dense as the pile on velvet, and the ventrals reduced to a single small spine, without soft rays.

The form of some is elevated¶; that of others round or oval**; they are all from the Indian Ocean.

PIMELEPTERUS, Lacép.,

Are distinguished from all other fishes by a single range of teeth placed in a horizontal base or heel, on the anterior edge of which is a part verti-

* American species, *Chæt. ciliaris*, L., Bl. 214, or *Isabelita*, Parra, VII, 1, or *Chæt. couronné*, Desmar. Dec. Ichtyol.;—*Chæt. tricolor*, Bl. 425; Duham. Sect. IV, pl. xxiii, 5. India species, *Chæt. bicolor*, Bl. 206, 1;—*Ch. mesoleucos*, Bl., or *mesomelas*, Gm., Bl. 216, 2;—*Holoc. amiralis*, Cuv., Ren. I, xvi, 92;—*Ch. annularis*, Bl. 215, 2;—*Ch. imperator*, Bl. 194;—*Ch. fasciatus*, Bl. 195;—*Ch. nicobariensis*, Bl. Schn. 50, or *Geometricus*, Lacép. IV, xiii, 1;—*Hol. Lamark*, Lacép. IV, 531, Renard, I, xxvi, 144, 145, and several new species.

† *Chæt. aureus*, Bl. 193, 1, or *Chirivita jaune*, Parra, VI, 2;—*Chæt. paru*, Bl. 197, or *Chirivita noir*, Parr. VI, 1;—*Ch. 5-cinctus*, Cuv., *Guaperva*, Marcgr. 178;—*Ch. arcuatus*, L., Bl. 204, 2.

‡ *Chæt. vespertilio*, Bl. 199, 2;—*Ch. teira*, Ib. I;—*Ch. guttulatus*, Cuv., Ren. II, xxiv, 129.

§ It is also the *Ch. pentacanthæ*, Lacép. IV, xi, 2, and the *Ch. orbicularis*, Forsk., or *Acanthinion orbiculaire*, Lacép. IV, 500.

|| Ittiol. Veron. pl. 4 and 6.

¶ *Psett. Sebæ*, Cuv., *Chætodon rhombeus*, Bl. Schn., Seb. III, xxvi, 21;—*Ps. rhombeus*, Cuv., or *Scomber rhombeus*, Forsk., or *Centrogaster rhombeus*, Gm., or *Centropode rhomboïdal*, Lacép., Russ. 59.

** *Psett. Commersonii*, Cuv., or *Monodactyle falciforme*, Lacép., II, v, 4, and III, 131, which very probably does not differ from the *Chæt. argenteus*, L., or *Acanthopode argenté*, Lacép.

cal and trenchant. The body is oblong, the head obtuse, and the fins thickened by the scales which cover them; from which circumstance their name is derived*. They are oval fishes, smooth, and covered with brown scales; they inhabit both oceans†.

A neighbouring genus is that of

DIPTERODON ‡,

Which has the teeth also trenchant, but cut sloping and not geniculate, and the spinous portion of the dorsal separated from the soft part by a deep emargination. The Cape, or

Dipt. capensis, Cuv., is the only species known.

The following genera, which we place next to *Chætodon* on account of their scaly fins, differ greatly from it, however, in the teeth with which their palatines and vomer are furnished. The genus

BRAMA §, *Bl. Schn.*,

The Sea-Breams, are connected with this family by the scales covering the vertical fins, which have but a small number of spinous rays concealed in their anterior edges; but they have slender teeth placed like cards in the jaws and palatines, an elevated profile, very short snout, a forehead descending vertically, and a mouth, when shut, that is almost vertical; the scales extend as far as on the maxillaries; there are seven rays in the branchiæ; a low dorsal and anal, but commencing in a salient point; a short stomach; a small intestine, and only five cæca.

But one species is known, *Sparus Raii*, Bl. 273; it inhabits the Mediterranean, and sometimes strays into the ocean; an excellent fish of a burnished steel colour, which attains a large size, but is infested with various species of intestinal worms.

PEMPHERIS, *Cuv.*,

Have a long and scaly anal, the dorsal short and elevated; head obtuse; the eye large; a small spine on the operculum; small crowded teeth in the jaws, vomer, and palatines. From the Indian Ocean||.

* *Pimelepterus* (fat fin). This genus of Lacépède, IV, 429, formed from Bosc, is the same as that of *XISTERE*, V, 484, formed from Commerson; and there is every reason to believe that the *Dorsuaire*, Lacép. V, 482, which is certainly identical with the *KYPHOSE*, III, 114, may very possibly also be the same as the *XISTERUS*.

† The *Piméloptère bosquien*, Lacép. IV, ix, 1, or *Chætodon cyprinaceus*, Broussonet;—the *Pim. marciac*, Quoy et Gaym. Voy. Freycin. pl. 62, f. 4;—*Pim. du Cap*, or *Kiphose double bosse*, Lacép. III, viii, 1;—a Brazil species, formerly named by Banks *Chætodon ensis*.

‡ This genus, the name of which is borrowed from Lacép., does not, however, contain the same species.

§ I strongly suspect that it is the *Brama* which M. Rafinesque has in view, in his *Lepodus saragus*, Nouv. Gen. No. 144. Shaw makes two species of it, but why, it is impossible to say, the *Sp. Raii*, and *Sp. castaneola*; the latter after Lacép.; but Lacép. made his genus only for the species of Bloch and Ray.

|| *Pempheris touca*, Cuv., *Sparus argenteus*, J. White, App. 267, or *Kurtus argenteus*, Bl. Schn. 164;—*P. mangula*, Cuv., Russ. 114;—*P. molucca*, Cuv., Ren. I, xv, 85, and Valent. No. 46.

TOXOTES, Cuv.

The Archers have the body short and compressed; the dorsal placed on the last half of the body, with very stout spines, the soft part, as well as that of the anal which corresponds to it, scaly; the snout depressed, short; lower jaw projecting beyond the upper one; the teeth quite as dense as the pile on velvet in both jaws, on the extremity of the vomer, palatines, pterygoids, and on the tongue; six rays in the branchiæ, inferior edge of the infra-orbital and preoperculum finely serrate. Their stomach is wide and short, with twelve cæcal appendages to the pylorus; natatory bladder large and thin.

The species known, *Toxotes jaculator*, Cuv.; *Labrus jaculator*, Shaw, vol. IV, part II, p. 485, pl. 68*, from Java, is celebrated for the same faculty that distinguishes the *Chæt. rostratus*, of spurting drops of water on the insects which adhere to aquatic plants, to bring them down for the purpose of seizing them. It can force the water to a height of three or four feet, and rarely misses its aim.

The seventh family of the Acanthopterygians, or

FAMILY VII.

SCOMBEROIDES,

The Scomberoid Fishes, is composed of a multitude of fishes with small scales, a smooth body, numerous cæca frequently united in clusters, and whose tail and caudal fin in particular are extremely powerful.

This is a family of the greatest utility to man, by the size of its fishes, by their agreeable flavour, and their inexhaustible reproduction, which brings them periodically into the same latitudes, where they constitute the object of the most extensive fisheries.

SCOMBER, Lin.

The Scombers have the first dorsal entire, while, on the contrary, the last rays of the second, as well as those of the anal, which correspond to them, are detached, forming what are termed false or spurious fins, or *pinnæ spurice*. The genus is subdivided as follows:

SCOMBER, Cuv.

The Mackerels have a fusiform body covered with uniformly small and smooth scales; two little cutaneous crests on the sides of the tail; an empty space between the first and second dorsal.

Sc. scombrus, L., Bl. 54. (The Common Mackerel). Blue back, varied with black undulating streaks; five false fins above and be-

* It is also the *Scarus Schlosseri*, Gm., Lacép. and Shaw, the *Sciæna jaculatrix* of Bonnatere, the *Labre sagittaire* of Lacép., and the *Coïus chatareus* of Buchanan.

neath. They visit in summer our sea-coasts in great abundance, and afford as large a supply of fresh and salt fish as the herrings. Sometimes they may be seen at other seasons; those which are caught in the early part of the spring are well known, in the sea-ports of France, under the title of Sansonnets. The Common Mackerel has no natatory bladder; but, and it is a singular fact, that organ is found in several other species, so similar to it, that some attention is necessary to distinguish them; such are the little *Mediterranean Mackerel*, *Sc. colias*; *Sc. pneumatophorus*, Laroche, Ann. Mus. XIII; and the *Sc. grex*, Mitch. Ann. New York Lyc. I, 423, which is sometimes seen on the coast of the United States, in countless numbers, &c.*

THYNNUS, Cuv.

The Tunnies have round the thorax a sort of corslet formed by scales larger and smoother than those on the rest of the body; a cartilaginous carina between the two little crests on the sides of the tail; the first dorsal extends so far as to be very close to the second.

Sc. thynnus, L. (The Tunny). This is the large fish which has been taken in the Mediterranean, from a very antient date, and by the astonishing abundance in which it is caught, and converted into oil, salt fish, &c., constitutes a great source of wealth to Provence, Sardinia, Sicily, &c. It is said to attain the length of fifteen and eighteen feet, and has nine spurious fins above, and as many beneath; the pectorals are one-fifth of its whole length. Several neighbouring species inhabit the Mediterranean, which have hitherto been but badly distinguished.

Sc. brachypterus, Cuv.; the *Alicorti*, Rondel., 245, and Duham., Sect. VII, pl. vii, f. 5. Pectorals but one-eighth of the whole length.

Sc. thunina, Cuv.; *La Tonine*, Aldrov. 315; Descrip. de l'Eg. Poiss. pl. xxiv, f. 5. A brilliant blue marked with black lines, undulated and curved in various ways, &c. It is also in this first group that we must place the

Sc. pelamys, L., Lacép. II, xx, 2. (The Tropical Bonita, or Rayed-belly Tunny). Four longitudinal blackish bands on each side of the belly†. The

ORCYNUS, Cuv.

The Germons only differ from the Tunnies in the extremely extended pectorals, which are one-third of the entire length, and reach beyond the anus.

Sc. alalonga, Gm.; *Germon* of the Biscayans; *Alalonga* of the Italians; Duham. Sect. VII, pl. vi, f. 1, under the improper name of Tunny; Willoughb. App. pl. x, f. 1, is taken in the Mediterra-

* Add, *Scomber vernalis*, Mitch. loc. cit.;—*Sc. canagurta*, Cuv., Russ. 136.

† Add, *Sc. coretta*, Cuv., Sloane, Jam. I, 1, 3;—*Dangiri mangelang*, Renard, I, lxxvi, 189.

nean, with the Tunny, and in summer visits the gulf of Gascony, in numerous bodies, where it constitutes an important fishery. The back is a blackish blue, gradually fading into the silvery white of the belly. It is frequently found to weigh eighty pounds; its flesh is much whiter than that of the Tunny.

AUXIS*, Cuv.

The Auxides have, with the corslet and moderate pectorals of the Tunny, the dorsals separate, as in the Mackerels. One species inhabits the Mediterranean.

Sc. bisus; the *Bonicou*, or *Scombre Laroche*, of Risso; Rafin. Caratt. pl. ii, f. 1; Egypt., XXIV, 6. Back of a fine blue; oblique blackish lines; flesh a deep red.

Another is taken in the Antilles, called the *Thon*, or *Tunny*, which attains a size equal to that of the European Tunny†.

SARDA‡, Cuv.

The Sardes are distinguished from the Tunnies solely by their separate, pointed, and very strong teeth.

Sc. sarda, Bl. 334; Aldrov. 313; Salvian. 123; Belon, 179§. The only species known, but common in the Black Sea and Mediterranean. It is blue, the back obliquely streaked with blackish; remarkable for the extreme length of its gall-bladder; a fact well known to Aristotle||. It also inhabits both oceans.

CYBIUM¶, Cuv.

The Tassards have the body elongated, and without a corslet; large, compressed, trenchant teeth, resembling lancets; palatine teeth dense as the pile on velvet. Several species are found in the hot parts of both oceans; some of them become very large**.

THYRSITES††, Cuv.

The Thyrsites differ from the Tassards in the anterior teeth, which are

* *Auxis*, antient name of a fish of the Tunny family.

† Add, the *Tasard*, Lacép. IV, p. 8;—the *Albacore*, Sloane, Jam. I, 1, 1.

‡ *Sarda* was the antient name of the Tunny that was caught and salted in the Western Ocean.

§ It is the *Amia* of the antients, and of Rondelet, 238; the *Sarda* of Rond. 248, is the young of the same species. It is also the *Scomber palamitus* of Rafin.; the *Sc. ponticus*, Pall. Zool. Russ.

|| Arist. Hist. II, c. xv. The gall-bladder of the common Tunny is equally as long.

¶ *Cybius*, the antient name of a dish prepared from the Tunny and from another fish of the same family.

** *C. Commersonii*, Cuv., *Sc. Commersonii*, Lacép., or *Konam*, Russ. 135;—*C. lineolatum*, Cuv., *Mangelang*, Russ. I, vii, 53;—*C. guttatum*, Cuv., or *Sc. guttatus*, Bl. Schn. pl. v, *Vingeram*, Russ. 134;—*C. maculatum*, or *Sc. maculatus*, Mitch. Ann. New York Lyc. I, vi, 8;—*C. Regale*, Cuv., or *Sc. regalis*, Bl. 333, which is also the *Scomberomere Plumier*, Lacép. III, 293;—*C. cavalla*, or *Guarapuca*, Marcgr. 178.

†† The antient name of some fish of this family.

longer than the others, and in having pointed, palatine teeth; no lateral carina to the tail.

This little subgenus leads insensibly to *Lepidopus* and to *Trichurus**.

GEMPYLUS†, Cuv.

The Gempyles are similar to *Thyrsites* in the jaw-teeth, but there are none in the palate, and the ventrals are almost imperceptible; an additional mark of affinity with *Lepidopus*‡.

XIPHIAS, Lin.

The Espadons, or Sword Fishes, belong to the family of the Scomberoides, and approach the Tunnies, particularly in their excessively small scales, in the carinæ on the sides of their tail, in the power of their caudal fin, and in their whole internal organization. Their distinguishing character consists in the beak, or long ensiform point or tusk, which terminates their upper jaw, and supplies them with a most powerful weapon of offence, with which they attack the largest sea animals. This beak is chiefly composed of the vomer and intermaxillaries, being strengthened at its base by the æthmoid, frontals, and maxillaries. Their branchiæ are not pectinated; each of them being formed of two large parallel laminae, the surface of which is reticulated§. They swim with astonishing swiftness, and their flesh is excellent.

XIPHIAS, Cuv.

The Sword Fishes, properly so called, have no ventrals. But one species is known(a).

Xiphias gladius, L. (The Common Sword-Fish). The point horizontally flattened and trenchant like the broad blade of a sword; sides of the tail strongly carinated. It has but one dorsal, which rises from before and from behind; the middle of it becoming worn with age gives it the appearance of being double. It is one of the largest and best fishes of the European seas, frequently attaining the length of fifteen feet. It is more common in the Mediterranean than in the Atlantic Ocean. A parasitic crustaceous animal|| pene-

* *Scomber dentatus*, Bl. Schn., or *Sc. atun*, Euphrasen and Lacép., or *Acinacée bâtarde*, Bory St. Vincent.

† The antient name of an unknown fish.

‡ *Gempylus serpens*, Cuv., or *Serpens marinus compressus lividus*, Sloane, I, 1, f. 2.

§ This led Aristotle to say that the *Xiphias* has eight branchiæ.

|| Improperly named by Gmelin, the *Pennatula filosa*.

(a) Another species is well known to British Ichthyologists, the *X. Notistium*, or Flying Sword-Fish. It possesses distinct ventral fins, and the dorsal being high and long enables this fish to swim with such velocity that its beak, striking against the stout oak plank of a ship, will pierce it. In the British Museum, in the Eleventh Room, may be seen in a case over the fire-place, a remarkably fine prepared specimen of this rare fish; the spectator will also see beside it, a piece of oak plank belonging to an East Indiaman, which had been pierced by one of the same species, but much larger than the specimen.—ENG. ED.

trates into its flesh, and sometimes renders it so furious that it dashes itself on shore*.

TETRAPTURUS, Rafin.

Have the point of the muzzle shaped like a stilet; each ventral consisting of a single non-articulated blade; two small salient crests on each side of the base of the caudal as in the Mackerel.

One species inhabits the Mediterranean, the *Aiguille* of the Sicilians, *Tetrapturus belone*, Rafin., Caratt. pl. i, f. 1.

MAKAIRA, Lacép.

Have the stilet-shaped point of the muzzle and two small crests of a *Tetrapturus*, but the ventrals are wanting.

But a single specimen has ever been seen, and that was captured at the island of Réen in 1802. It is the *Mak. noiratre*, Lacép.; *Xiphias makaira*, Sh.†

ISTIOPHORUS, Lacép.—NOTISTIUM, Herman.

The Sails have the beak and caudal crests of a *Tetrapturus*, but the dorsal is very high and serves them for a sail when swimming; their long and slender ventrals are composed of two rays.

There are several imperfectly determined species, one of which inhabits the Indian Ocean, *Scomber gladius*, Broussonet, Acad. des Sc. 1786, pl. x; *Xiphias velifer*, Bl. Schn.; *Xiphias platisterus*, Shaw, IV, part II, p. 101, and was long ago described‡.

All the fishes of this genus attain a very large size.

CENTRONOTUS, Lacép.

The *Centronotes* comprise a great genus of *Scomberoides* characterized by the spines, which, in the *Acanthopterygians* in general, form the anterior portion of the dorsal, or a first separate dorsal, but in them are free and unconnected by a common membrane; they all have ventrals. They are subdivided as follows:

NAUCRATES, Rafin.

The *Pilots* have free dorsal spines; body fusiform; a carina in the sides of the tail as in the Tunny, and two free spines before the anal fin.

The common species, or the *Fanfres* of the sailors of Provence;

* N.B. The *Xiph. imperator*, Bl. Schn., pl. 21, taken from Duham. Sect. IV, pl. xxvi, f. 2, is merely a copy of a bad figure given by Aldrovande (Pisc. p. 332), for that of the common *Xiphias*. This species must consequently be suppressed.

† It yet remains to be seen whether this was not a *Tetrapturus* that, had lost its ventrals. The fig. of Lacép. IV, xiii, 3, is taken from the rude drawing of a fisherman.

‡ It has also been figured by Nieuhof, App.; Willoughb. App. pl. V, f. 9, by Renard, I, pl. 34, f. 182, and II, pl. 54, f. 233; by Valentyn, No. 527. The *Guebucu*, Marcgr. 171, hardly appears to differ from the species of India, Bl. 345; is a falsified copy of a figure of Pr. Maurice, which differed much less from that of Marcgrave.

Gasterosteus ductor, L.; *Scomber ductor*, Bl. 338, (The Pilot-Fish), is blue, with broad vertical bands of a much deeper blue. The name of *Pilot-Fish* owes its origin to the fact, that it follows vessels to seize upon what may fall from them; and, as a similar habit is observed in the Shark, it has been said that the former acts as a guide or pilot to the latter; it is not above a foot long.

A black species is found at Brazil, the *Ceixupira*, Marcgr. 158; *Scomber niger*, Bl. 337, which is eight or nine feet in length.

ELACATES

Have the general form of the Naucrates, and their free dorsal spines; but the head is horizontally flattened, and both the caudal carina and the free spines before the anal are wanting*.

LICHIA, Cuv.

The Lichia have the free spines on the back, and two others, also free, before the anal; body compressed, and the tail without the lateral carinæ. In front of the dorsal spines is a single one, laid flat, and pointing forwards.

Three species inhabit the Mediterranean, all of which are eatable, and already well characterized by Rondelet.

L. amia; *Scomber amia*, L.; the *Lichia proper*, or *Vadigo*, Rondelet, 254; *Amia*, Salv. 121. The lateral line strongly covered or forming an S; a large species more than four feet in length, and weighing a hundred pounds.

L. glauca; *Sc. glaucus*, L.; the *Derbio*, Rondel. 252. The lateral line nearly straight; the anal and second dorsal marked with a black spot in front; teeth small and crowded.

L. sinuosa, Cuv.; Rond. 255. (The Sinuous Lichia). The blue on the back separated from the silvery hue on the belly by a zigzag line; the hooked teeth in a single range†.

Lacépède separates from the Lichia, by the name of SCOMBEROIDES, which is not very appropriate, those species where the last rays of the second dorsal and of the anal are divided into spurious fins, as in the Mackerels‡. The

TRACHINOTUS, Lacép.

From which his ACANTHINIANS and CÆSIOMORES do not generically differ, are Lichia with an elevated body, and a more vertical profile, and the dorsal and anal tapered into longer points§.

* *El. motta*, Cuv., *Pedda mottah*, Russel, 153; *El. americana*, Cuv., *Centronotus spinosus*, Mitch. Ann. cit. Nov. I, iii, 9, which is probably the *Gasterosteus canadensis*, L.; and some new species.

† Add, *Scomb. calcar*, Bl. 336, f. 2.

‡ *Scomb. Forsteri*, Bl. Schn., or *Scomberoïde Commersonien*, Lacép. II, xx, 3, or *Aken parah*, Russ. 141;—*Tolparah*, Russ. 138;—*Sc. aculeatus*, Bl. 336, 1;—*Sc. lysan*, Forsk.;—*Sc. saliens*, Bl. 335; and Lacép. II, xix;—*Gasterosteus occidentalis*, L., Brown. Jam. xlv, 2;—*Quiebra-acha*, Parra, xii, 2.

§ *Chaetodon glaucus*, Lacép. 210, or *Acanthinion bleu*, Lacép. IV, 500;—*Chaet. rhomboides*, Bl. 209, or *Ac. rhomboïde*, Lacép.;—*Gast. ovatus*, L., or *Mookalée parah*, Russ. 154;—*Cæsiomore Bloch*, Lacép. III, iii, 2;—*Scomber falcatus*, Forsk.;—*Cæsiomore baillon*, Lacép. III, iii, 1;—*Botlah-parah*, Russel, 142.

RHYNCHOBDELLA, *Bl. Schn.*

Have free spines on the back as in *Centronotus*, and two free spines before the anal, but, as in a true *Xiphias*, the ventrals are wanting; the body is elongated. They are divided into two subgenera. In

MACROGNATHUS, *Lacép.*

The muzzle is prolonged into a cartilaginous point, which extends beyond the lower jaw; the second dorsal and the anal are distinct from the caudal*.

MASTACEMBELUS, *Gronov.*

The two jaws about equal, and the dorsal and anal almost united with the caudal†. Both subgenera inhabit the fresh waters of Asia and feed on worms, which they obtain from the sand. Their flesh is much esteemed.

This is perhaps the proper place for a genus not yet well understood. The

NOTACANTHUS, *Bl.*—*CAMPILODON*, *Oth. and Fab.*

The body much elongated, compressed, and covered with small soft scales; the obtuse muzzle projects in front of the mouth, which is armed with fine and closely-set teeth; nothing on the back but free spines; ventrals behind and beneath, or on the abdomen; a very long anal reaches to the tip of the tail, where it unites with a very small caudal.

Not. nasus, *Bl.* 431. The only species known; it inhabits the Arctic Ocean, and is two feet and a half in length.

SERIOLA, *Cuv.*

The Serioles present all the characters of a *Lichia*; a horizontal spine before the first dorsal; a small free fin supported by two spines before the anal; body compressed; a lateral line without carina or armature; but the spines of the first dorsal are united into a fin by a membrane.

One species, the *Pêche lait* (Milk Fish) of the French at Pondicherry; *Scomber lactarius*, *Bl. Schn.*; *Russ.* 108; is remarkable for the great delicacy of its flesh.

Another, *Seriola cosmopolita*, *Cuv.*; *Scomber chloris*, *Bl.* 339, is noticed as one of the few fishes common to both oceans‡.

There is a species whose last dorsal and anal ray is detached, *Seriola bipinnulata*, *Cuv.*; *Zool. de Freycin.*, pl. 61, f. 3.

* *Rhynchobdella orientalis*, *Bl. Schn.*, or *Ophidium aculeatum*, *Bl.* 159, 2, or *Macrognathus aiguillonné*, *Lacép.* II, viii, 3;—*Rh. polyacantha*, *Bl. Schn.*, or *Macrognathus armé*, *Lacép.*; *Buchan*, pl. xxxvii, x, 6;—*Rh. aral*, *Bl. Schn.*, pl. lxxxix;—*Macrognathus pancealus*, *Buchan*, xxii, 7.

† *Rhynchobdella halepensis*, *Bl. Schn.*; *Gronov. Zooph.*, pl. viii, a, x.

‡ Add, *Seriola Dumeril*, *Risso*;—*Scomber fasciatus*, *Bl.* 341;—*Seriola de Rafinesque*, *Risso*, or *Trachurus aquilus*, *Raff. Caratt.* xi, 3.

NOMEUS, Cuv.

The Shepherds, which for a long time were placed among the Gobies, are related in many particulars to the Serioles, but their extremely large and broad ventrals, attached to the belly by their internal edge, give them a very peculiar character.

Nom. mauritii, Cuv.; the *Harder*, Marcgr. 153. A species from the American seas; silvery, with transverse black bands on the back*.

TEMNODON, Cuv.

The Temnodians have the tail unarmed; the small fin, or free spines before the anal, of the Serioles; the first dorsal is very slight and low, the second and the anal covered with small scales; but their principal character consists in a range of separate, pointed and trenchant teeth in each jaw; behind these, above, is a row of small ones, and the vomer, palatines and tongue are furnished with others, very small and crowded. The operculum terminates in two points, and there are seven rays in the branchiæ.

Tem. saltator, Cuv. The only well known species; it is about the size of a Mackerel, and one of the small number of fishes common to both oceans†.

CARANX, Cuv.

Scomberoides characterized by a lateral line more or less mailed with scaly plates or bands, carinated and frequently spinous. They have two distinct dorsals, a horizontal spine before the first; the last rays of the second but slightly connected, and sometimes separated into spurious fins; some spines free, or forming a small fin before the anal.

Several species inhabit the seas of Europe, resembling the Mackerel in form and flavour, and remarkable for the bands or plates which cover their lateral line, commencing from the shoulder.

They are confounded under the name of *Saurels*, *Bastard Mackerel*, &c.—*Scomber trachurus*, L.; but they differ in the number of bands‡ and the more or less sudden curvature of the lateral line. Species very similar to those of Europe are found as far as New Zealand.

In some, the plates merely cover the posterior and straight part of the

* It is the *Gobius Gronovii*, Gmel., the *Gobiomora Gronovien*, Lacép., the *Eleotris mauritii*, Bl. Schn., and the *Scomber zonatus*, Mitch. Ann. Op. cit. I, iv, 3,—it attains the size of a Salmon. The other *Harder* of Marcgr. Braz. 166, appears to be a *Mugil*. *Harder* or *Herder* (Shepherd), is a name applied by Dutch sailors to various fishes for reasons similar to those which have induced European mariners to call the Naucrates, Pilot-fish, &c. It is even possible that from the resemblance of the black bands, our *Nomeus* may have been confounded with it.

† We possess specimens which scarcely differ from each other, from Alexandria, the United States, Brazil, Cape of Good Hope, and New Holland. It is the *Cheilodiptère heptacanthé*, Lacép. III, xxi, 3, copied from Commerson, and his *Pomatomeskib*, IV, viii, 3, from Bosc. It is also the *Perca saltatrix*, L.; Catesb. II, viii, 2, or *Spare sauteur*, Lacép. Add, *Perca antarctica*, Carnich., Lin. Trans. XII, xxv?

‡ There are from seventy to a hundred of these bands.

lateral line, its anterior and arcuated portion being furnished with small scales. Some are fusiform, and of these, one has a single spurious dorsal and anal fin*, another has several†, but most of them have none‡.

Others again, which have a more elevated body, but still retain the oblique and but slightly convex profile, are remarkable for a single range of teeth§.

Some fishes of this genus, termed CARANGUES by the French sailors, have an elevated body and a sharp profile, curved into a convex arch, and descending suddenly. The species are very numerous in both oceans.

C. carangus; *Scomber carangus*, Bl. 340. (The Carangue of the Antilles). Silvery, with a black spot on the operculum, and frequently found to weigh from twenty to twenty-five pounds; an excellent fish. A very similar species, but in which the black spot is wanting, the

Guaratereba, Seb. III, xxvii, 3, (The Bastard Carangue), is, on the contrary, very apt to prove poisonous||.

We might also distinguish those species which have no teeth**, and those, the points of whose second dorsal and anal are extremely elongated, which I have designated by the name of CITULÆ††.

We are thus gradually led to fishes which may be united under the common name of

VOMER,

which become more and more compressed and elevated, where the armature of the lateral line successively diminishes, and the skin becomes fine, satiny, and without any apparent scales, which have no other teeth than those dense as the pile on velvet, and which are distinguished from each other by various prolongations of some of their fins.

Linnaeus and Bloch placed them, but improperly, in the genus ZEUS. We divide them as follows:

OLISTUS, Cuv.

Differ from Citula, inasmuch as the middle rays of the second dorsal are

* *Kurra-woodagahwah*, Russ. 139;—*Car. punctatus*, Cuv., called *Scomber hippos*, by Mitch., New York, op. cit. I, v, 5, but which is not the hippos of Linnaeus;—*Curvata pinima*, Marcgr. Braz. 150.

† *Scomber Rotleri*, Bl. 346, and Russel, 143;—*Sc. cordyla*, L., but not his synonimes, which are CARANGI.

‡ *Scomb. crumenophthalmus*, Bl. 343;—*Sc. Plumieri*, Bl. 344, the same as the *Sc. ruber*, 343, and as the *Caranx Daubenton*, Lacép. III, 71.

§ *Scomb. dentex*, Bl., Schn.;—*Caranx lune*, Geoff. Saint-Hil., Eg. Poiss. xxiii, 3, to which the *Citula Banskii*, Riss., 2d ed. VI, 13, and perhaps the *Trachurus imperialis*, Rafin., Car. XI, 1, are, at least, closely allied.

|| Add, the *Scomb. hippos*, L., which is the *Sc. chrysos*, Mitch.;—*Ekalah parah*, Russ. 146, perhaps the *Scomb. ignobilis*, Forsk.;—*Car. sex-fasciatus*, Quoy et Gaym., Zool., Freycin. pl. 65, f. 4;—*Jarra dandree parah*, Russ. 147;—*Scomb. Kleinii*, Bl. 347, 2;—*Sc. Sansun*, Forsk.;—*Kuguroo-parah*, Russ. 145;—*Talan-parah*, Id. 150, or *Scomb. malabaricus*, Bl., Schn.;—*Wootin-parah*, Russ. 148.

** *Scomb. speciosus*, Lacép. III, 1, 1, or *Polooso-parah*, Russ. 149, of which the *Car. petaurista*, Geoff., Egypt. XXIII, 1, appears to be the adult.

†† *Tchawil-parah*, Russ. 151;—*Mais-parah*, Id. 152.

not branched, but merely articulated, and are extended into long filaments*.

SCYRIS, *Cuv.*

Have the same filaments, and nearly a similar form; but the spines which should form the first dorsal are entirely hidden in the edge of the second. The ventrals are short†.

BLEPHARIS, *Cuv.*

Have long filaments to the second dorsal and anal; ventrals much prolonged, the spines of the first hardly piercing the skin‡; body elevated; the profile not more curved than usual.

GALLUS, *Cuv.*

Have the profile more vertical than in *Blepharis*, but all the other characters similar§.

ARGYREYOSUS, *Cuv.*

The profile still more elevated; the first dorsal decidedly marked, and some of its rays prolonged into filaments like those of the second. Their ventrals also are much lengthened||. In

VOMER, *properly so called,*

The body is compressed, and the profile vertical, as in *Gallus* and *Argyreyosus*, but there is no prolongation to any of the fins¶. The genus

ZEUS, *Lin.*

After abstracting the *Galli* and *Argyreyosi*, &c., comprehends fishes with a compressed body, an extremely protractile mouth like that of the *Menides*, and having but few and weak teeth. They require, however, to be greatly subdivided.

ZEUS, *Cuv.*

The *Dories* have dorsal emarginate, its spines accompanied by long slips of the membrane; a series of bifurcated spines along the base of the dorsal and the anal.

Z. faber, L., Bl. 41. (The Common Dory). Yellowish, with a

* The species is new.

† The *Gal. d'Alexandrie*, Geoff., Eg. Poiss. XXII, 2.

‡ *Zeus ciliaris*, Bl. 196;—*Zeus sutor*, Cuv., the *Cordonnier* of Martinique.

§ *Zeus gallus*, L., Bl., or *Gurrah-parah*, Russ. 57;—*Chewoola-parah*, Id. 58.

|| *Zeus vomer*, Mus. Ad. Fred. xxxi, 9, and better, Bl. 93, 2, or *Abacatuia*, Marcgr. 161;—*Zeus rostratus*, Mitch., op. cit. II, 1. N. B. The *Zeus niger*, Bl. Schn., is founded on a mistake; a figure of the *Abacatuia*, in the work of Marcgrave, p. 145, being placed next to the description of the *Guaperva* or *Chatodon arcuatus*. The *Sélène argentée*, Lacép. IV, ix, 2, is an *Abacatuia*, whose first dorsal and ventrals had been worn. His *Sélène quadrangulaire* is the *Chat. faber*.

¶ *Zeus setapinnis*, Mitch., op. cit. I, 9, Labat. Voy. de Desmarchais, I, p. 312.

round black spot on the flank; an excellent fish, that is sometimes styled the *Fish of St. Peter* (a).

Z. pungio, Cuv.; Rond. 328, is another species, distinguished by a stout bifurcated spine on the shoulder. From the Mediterranean.

CAPROS, *Lacép.*

Have the emarginated dorsal of the Dories, and a mouth still more protractile; but no spines along the dorsal and anal; the entire body covered with very rough scales.

But one species is known, *Zeus aper*, L., which is small and yellowish. It inhabits the Mediterranean*. The

LAMPRIIS, *Retzius*.—CHRYOTOSUS, *Lacép.*

Have but a single dorsal, highly elevated before, as is the case with the anal; and which has but one small spine at the base of its anterior edge. There are ten very long rays to each ventral; the lobes of their caudal are also very long, but all these prolongations become worn away with age; sides of the tail carinated.

Lamp. guttatus, Retz. Violet spotted with white, and has red fins†. It attains a large size, and inhabits the Arctic seas; the only species known.

EQUULA, *Cuv.*

The Equula have only a single dorsal, but with several small spines, the anterior of which are sometimes very long; the snout highly protractile; body compressed; edges of the back and belly dentated along the fins. They are small fishes, several species of which inhabit the Indian Ocean‡.


The snout of some of these species, when in a state of quiescence, is singularly retracted; by suddenly protruding it they are enabled to seize upon such small fishes or insects as may pass within reach§.

* It is also the *Perca pusilla* of Brunnich.

† It is the *Zeus regius*, Bonnat. Encycl. Ichtyol., f. 155; the *Z. imperialis*, Shaw, Nat. Misc., No. 140; the *Z. luna*, Gmel.; the *Z. guttatus*, Brunnich, Soc. des Sc. de Copenh. III, 388; the *Scomber pelagicus*, Gunner, Mem. de Dronth. IV, xii, 1; the *Chrysotose lune*, Lacép. IV, ix, 3; the *Moon-Fish*, Duham., Sect. IV, pl. vi, f. 5; the *Opah* of Pennant, &c.

‡ The type of this genus is the *Scomber equula* of Forskhal, of which Gmelin has made his *Centrogaster equula*, and Lacép. his *Casio poulain*. Add, *Eq. ensifera*, Cuv., or *Scomber edentulus*, Bl. 428, or *Leyognathe argenté*, Lacép.;—*Eq. cara*, Cuv., Russ. 66;—*Eq. fasciata*, Cuv., or *Clupea fasciata*, Lacép. V, p. 463, Mem. du Mus. I, xxiii, 2;—*Eq. splendens*, Cuv., Russ. 61;—*Eq. daura*, Cuv., Russ. 65;—*Eq. totta*, Russ. 62;—*Eq. coma*, Russ. et Seb. III, xxvii, 4, 63;—*Eq. ruconius*, Buchan, XII, 35;—*Eq. minuta*, Cuv., or *Scomber minutus*, Bl. 429, 2, which may very possibly be the same as the *Zeus argentarius*, Forster, IX, Schn. 96.

§ *Eq. insidiatrix*, Cuv., or *Zeus insidiator*, Bl. 192, f. 2 and 3.

 (a) The legend on which this title is founded represents the Dory to have been the fish from which St. Peter took the tribute money, and the impression of his finger and thumb on the sides of its body were destined to commemorate the miracle.
—ENG. ED

MENE, *Lacép.*

Have the snout of an Equula, and the entire body more compressed; abdomen trenchant, and very convex beneath; a circumstance resulting from the development of the bones of the shoulder and pelvis, while the dorsal line is almost straight, which throws the ventrals behind the pectorals.

But one species is known, the *Mené Anne-Caroline*, Lacép. V, xiv, 2, or the *Zeus maculatus*, Bl., Schn., pl. xxii, Russel, 60. It is of a fine silver colour, spotted with blackish near the back. From the Indian Ocean.

STROMATEUS, *Lin.*

Possess the same compressed form as is found in the different species of Zeus, and similar diminutive and slightly apparent scales, under a satiny epidermis; but the snout is obtuse and non-protractile: a single dorsal whose few spines are concealed in its anterior edge; no ventrals. The vertical fins are sufficiently thick to tempt us to approximate them also to the Squammipennes. Independently of the ordinary lateral line, there is a stria on the flank which has been considered as a second one. The œsophagus is armed with a number of spines which are attached to the velvet by radiating roots.

S. fiatola, L.; Belon, Aquat. 153; Rondel. 493*. A pretty, oblong species, inhabiting the Mediterranean, remarkable for spots and interrupted bands of a golden tint, on a lead-coloured ground.

S. stellatus, Cuv., from the coast of Peru, is nearly similar in form, but is sprinkled with black spots; it is common in the markets at Lima.

Several other species inhabit the Indian Ocean, called by the French colonists *Pamples* (a). They are generally more elevated than the fiatola, and spines or trenchant blades are frequently found before their dorsal, and even their anal†. We may distinguish from among them the

PEPRILUS, *Cuv.*

In which the pelvis forms a trenchant and pointed blade before the anus,

* This fig., in which the left pectoral is bent downwards, being mistaken by Lacép. for a ventral, gave rise to his genus *Chrysostromus*, which must consequently be suppressed.

† The *Stromateus niger*, Bl. 422, and better, 160, under the false name of *Str. paru*, Russ. 43;—the *Str. albus*, Cuv., Russ. 44;—*Str. candidus*, Cuv., Russ. 42;—*Str. argenteus*, Euphrasen, New Stockh. Mem. IX, pl. ix, or *Str. aculeatus*, Bl., Schn.; *Str. griseus*, Cuv.

(a) And, by the English in India, *Pomfret*. One of the species of the Indian fishes, *S. Niger*, the Black Pomfret, is caught plentifully in the roads of Pondicherry, in the months of March and April. They are taken in great abundance only at intervals, as the fish collect together near the coast, and remain there for two or three days, then disappear for about the same period, when they return, and thus continue for some time the alternate movement. The fish must be eaten within a few hours after being caught.—ENG. ED.

that might be taken for a vestige of the ventrals*. Besides this, there are the trenchant blades of which we have just spoken, and there is even one species in which these blades are crenated†.

LUVARUS, Rafn.,

Appear to be closely approximated to *Peprilus*; the extremity of the pelvis is furnished with a small scale that acts as an operculum to the anus; no trenchant blades; a prominent carina on each side of the tail, as in the Tunny, &c.

Luv. imperialis, Rafn. Ind. d'Ittiol. Sicil. pl. i, f. 1. Silvery, with a reddish back; an extremely large species that inhabits the seas of Europe‡.

SESERINUS, Cuv.,

Have all the characters of the *Stromatei*, even internally; but on them are seen two small ventrals, or rather vestiges of ventrals.

Ses. Rondeletii, Cuv.; Rondel. 257. A small species from the Mediterranean.

KURTUS, Bl.

The *Kurtus* are closely allied to *Peprilus*, from which they particularly differ in the less extent of their dorsal, and in the development of their ventrals: the anal is long, the scales are so extremely small that they are hardly visible till the skin is dried; there are none on the fins; seven rays in the branchiæ; a pelvic spine between the ventrals, and several small trenchant blades before the dorsal, at whose base is a spine directed horizontally forwards.

A singularity of structure is presented in their skeleton; the ribs are dilated, convex, and form rings which are in contact with each other, thus enclosing a conical and empty space, which extends beneath the tail, in the inferior rings of the vertebræ, in a long and thin tube which contains the natatory bladder. The

Kurt. indicus, Bl. 169, is very probably the female of the *Kurtus cornutus*, or *Somdrum-Kara-Mottee* of Russel, a fish very remarkable for a little cartilaginous and curved horn, which rises from the first of the small trenchant blades before the dorsal.

CORYPHÆNA, Lin.

The *Coryphæna*, vulgarly called *Dories*, and, by the Dutch, *Dolphins*: the body compressed, elongated, covered with small scales; upper part of the head trenchant; a dorsal extending along the whole of the back,

* *Chætodon alepidotus*, L., or *Stromateus longipinnis*, Mitch.;—*Str. cryptosus*, Mitch.;—*Str. paru*, Sloane, Jam. II, pl. ccl, f. A.

† *Peprilus crenulatus*, Cuv., a small and new species.

‡ A specimen was taken at the Isle of Ré, in 1826, a drawing of which was forwarded to us by M. Journal Rouquet, one of the custom-house officers of that island. I suspect that we should refer to it, at least as a congener, the *Ausonia Cuvieri*, Risso, 2nd ed. pl. xi, f. 28, which is figured, however, with two anal spines.

composed of rays almost equally flexible, although there is no articulation to the anterior ones; seven rays in the branchiæ.

CORYPHÆNA, *Cuv.*

The Coryphænæ, properly so called, have the head much elevated; the profile curved into an arc which descends very suddenly; eyes very far down; teeth in the palate as well as in the jaws. Large and beautiful fishes, celebrated for the rapidity of their motions, and the eternal war they wage against the Flying Fish.

C. hippurus, L. (The Mediterranean Coryphæna). Sixty dorsal rays; a silvery-blue above, with deep blue spots; a lemon-yellow, with light blue spots beneath. Several neighbouring species are found in the ocean, hitherto confounded with it*.

CARANXOMORUS, *Lacép.*,

Have the head oblong and but slightly elevated, the eye in a mediate position, thus differing in both these respects from the true Coryphænæ†. In the

CENTROLOPHUS, *Lacép.*,

The palatine teeth are wanting; there is an interval without rays between the occiput and the commencement of the dorsal‡. A species of each of these two last subgenera inhabits the Mediterranean, and occasionally strays into the ocean.

ASTRODERMUS, *Bonnelli*,

Have the elevated and trenchant head and long dorsal of the Coryphænæ; but the mouth is slightly cleft, there are but four rays in the branchiæ, and their ventrals are very small and placed on the throat; but their peculiar character is, that the scales scattered over the body assume the radiated form of small stars.

Astrod. guttatus, Bonn.; *Diana semilunata*, Risso, Ed. II, pl. vii, f. 14. Silvery, spotted with black; red fins, and a very high dorsal. From the Mediterranean, and the only species known§.

PTERACLIS, *Gronov.*—OLIGOPODUS, *Lacép.*

Teeth and head of the Coryphænæ; but the scales are larger, the ventrals jugular and very small, and the dorsal and anal as high as the fish itself.

* We will describe several of them in our Ichthyology, and endeavour to settle their synonymes.

† *Scomber pelagicus*, L., Mus. Ad. Fred. xxx, f. 3, or *Cychla pelagica*, Bl. Schn.; —*Cor. fasciolata*, Pall. Spic. Zool. Fasc. VIII, pl. iii, f. 2.

‡ *Coryphæna pompilus*, L., Rondel, 250;—the *Centrolophe nègre*, Lacép. IV, 441, the same as the *Perca nigra*, Gmel., Borlasse, Hist. of Cornw. pl. xxvi, f. 8, or *Holo-centre noir*, Lacép.; the *Merle*, Duham. Sect. IV, pl. vi, f. 2.

§ *Astrodermus guttatus*, Bonelli, or *Diana semilunata*, Riss. 2nd ed. VII, f. 14.

P. velifer; *Coryphæna velifera*, Pall. Spic. Zool. Fasc. VIII, pl. 1*. From the Carolinas, and the only species known (*a*).

The Eighth Family of Acanthopterygians, that of

FAMILY VIII.

TÆNIOIDES,

Tænioids, or Ribband Fish, is closely connected with the Scomberoides, and its first genus is even intimately allied with Gempilus and Thyrsites; the fishes which compose it are elongated, flattened on the sides, and have very small scales.

The first tribe has the muzzle elongated, the mouth cleft and armed with strong, pointed, and trenchant teeth, and the lower jaw advancing beyond the upper one: it comprises but two genera,

LEPIDOPUS, *Gouan.*,

Whose special character consists in the reduction of the ventrals to two small scaly plates; the thin and elongated body is furnished with a dorsal above, which extends throughout its length, with a low anal beneath, and terminates in a well-formed caudal; there are eight rays in the branchiæ; the stomach is elongated, with upwards of twenty cæcums near the pylorus, and a prominent glandular body is attached to the natatory bladder, which is long and slender.

Lep. argyreus, Cuv. (The Garter Fish). Frequently five feet in length; it has been described under several names†, and is found from England to the Cape of Good Hope, but is rare every where.

TRICHIURUS, *Lin.*—LEPTURUS, *Artedi*,—GYMNOGASTER, *Gronov.*,

Have the form of body, muzzle, and jaws, similar pointed and trenchant teeth, and a dorsal extending along the back, as in *Lepidopus*; but the

* Bosc assures us that he caught it in Carolina; Pallas says that his is from the Moluccas.—They may be different species.

† It is the *Lepidopus* of *Gouan.*, Hist. Pisc. pl. i, fig. 4; the *Trichiurus caudatus*, Euphrasen, New Stockh. Mem. IX, pl. ix, f. 2; the *Trich. gladius*, Holten, Soc. Hist. Nat. Copenh. V, p. 23, and pl. ii; the *Trich. ensiformis* of Vaudelli, or *Vandellius lusitanicus* of Shaw; the *Zipotheca tetradens* of Montagu, Werner, Soc. I, p. 81, pl. ii; the *Sarcina argyrea*, Rafin. Nouv. Caratt. pl. vii, f. 1; the *Lepidope Peron*, Riiss.; and the *Lepidope argenté* of Nardo.

Ⓔ (*a*) In the ninth volume of his great work on Ichthyology, Cuvier is enabled to describe three more species. The first is the *P. ocellatus*, brought home by the naturalists, Quoy and Gaymard; it was found in the stomach of a *bonita*, which was caught in the Indian Sea, near Madagascar, in south latitude 30°, and was so fresh at the time, that it must have been then but recently swallowed. The other two species are *P. trichepterus* and *P. Carolinus*. The whole are in the King's Cabinet in Paris.—ENG. ED.

ventrals and caudal are wanting, and the tail is drawn out into a long, slender, and compressed filament. In lieu of the anal there is merely a suite of small and hardly perceptible spines on the under edge of the tail; the branchiæ have but seven rays. They resemble beautiful silver ribbands; their stomach is elongated and thick; their intestines straight; their cæca numerous, and their natatory bladder long and simple.

Trich. lepturus, Lin.; Brown, Jam. pl. xlv, f. 4*, is found in the Atlantic, both on the coast of America and that of Africa.

Two other species are known from the Indian Ocean, one of which, *Trich. haumela*, Schn.; *Clupea haumela*, Forsk. and Gmel.; *Savala*, Russel, I, 41, is very similar to the *Lepturus*, being only somewhat shorter. The other, *Trich. savala*, Cuv., is still less elongated, and has a smaller eye†.

A second tribe comprehends genera in which the mouth is small, and but slightly cleft.

GYMNETRUS, Bl.,

Have the body elongated and flat, as in all the preceding divisions, and totally deprived of the anal fin; but there is a long dorsal whose lengthened anterior rays form a sort of panache, but they are easily broken; the ventrals, when not worn or broken, are very long, and the caudal, composed of very few rays, rises vertically from the extremity of the tail, which ends in a small hook. There are six rays in the branchiæ; the mouth is slightly cleft, very protractile, and furnished with but few and small teeth; some small spines on the lateral line, which are more salient towards the tail. These fishes are extremely soft, and their rays are fragile; they have been frequently and incorrectly figured from mutilated specimens‡; their skeleton has the bones, especially those of the vertebræ, but very slightly indurated, their stomach is elongated, and their cæca are very numerous; the natatory bladder is wanting, and their mucous flesh is very rapidly decomposed.

* It is the *Ubirre* of Laet., Ind. Occid. 573, which, through a mistake, pointed out by himself, he has placed in Marcgr. p. 161, as belonging to the description of the *Alucu*, which is a *Muræna*; this mistake has produced such confusion, that Bloch and others were led to believe that the *Trichiurus* is a fresh-water fish.

† A transposition in the text of Nieuhof has caused electric properties to be attributed to the *Trichiuri* of India, which they most assuredly do not possess.

‡ The *Falx venetorum* of Belon, of which Gouan has made his genus *TRACHYPTERUS*, and which has become the *Cepola trachyptera*, Gmel., only differs from the *Tænia altera* of Rondel, 327, and even from his *Tænia prima*, which is the *Cepola tænia*, L., and from the *Spada maxima*, Imperati, 587, or *Cepola gladius* of Walbaum, and from the *Tænia fulcata*, Aldrov., or *Cepola iris* of Walbaum, in the various degrees of individual mutilation. It is the same with respect to the *Vogmar* of the Icelanders of Olafsen and Powelsen, Isl. tr. fr. pl. li, or *Gymnogaster arcticus* of Brünich, Scient. Soc. Copenh. III, pl. xiii, which is the genus *BOGMARUS*, Bl. Schn.; with respect to the *Gymnetre cépèdien*, Risso, Ed. I, pl. v, f. 17; to the *Argyctius quadrimaculatus*, Rafin. Caratt. I, f. 3; to his *Scarcina quadrimaculata* and *imperialis*; to the *Gymnetrus mediterraneus* of Otto; to the *Epidesmus maculatus* of Ranzani, Opusc. Scientif. Fascic. VIII, and to the *Regalecas maculatus* of Nardo, Phys. Journ. Pavia, VIII, pl. i, f. 1. All these fishes hardly differ in species, and not in the least as to genus. Bonelli is the person who has described the least mutilated specimen: he calls it the *Trachypterus cristatus*, Acad. Turin, XXIV, pl. ix.

Several species are found in the European seas which differ in the number of their dorsal rays, and which, when entire, that is when young, frequently present a most singular appearance from the prolongation of their fins.

The most brilliant of the Mediterranean species has but from one hundred and forty to one hundred and fifty dorsal rays: all that have been caught were either small or of a middling size. Another has from a hundred and seventy to a hundred and seventy-five rays, specimens of which are found in cabinets, from four to five feet in length. A third has more than two hundred of these rays, and is more than seven feet in length.

The Arctic Ocean produces two species, called in Norway the King of the Herrings*; to one of which some give one hundred and twenty rays, and others give one hundred and sixty, and say that it attains the length of ten feet; the other has more than four hundred rays, and is eighteen feet in length†. The ventrals consist of a long filament dilated near the extremity. They are also found in India‡.

STYLEPHORUS, Shaw.

A vertical caudal, as in *Gymnetrus*, but shorter; the extremity of the tail, instead of being curved into a small hook, is prolonged into a slender cord longer than the body.

S. chordatus, Shaw, Lin. Trans. I, vi, Nat. Misc. VII, pl. 274, and Gen. Zool. IV, part I, pl. ii. There is only known a badly preserved specimen, which was taken in the Gulf of Mexico, and even of it, for a long time, we only had quite a mutilated drawing. M. de Blainville, however, has given us a more faithful representation; Journ. de Phys. tome LXXXVII, pl. i, f. 1, which exhibits no ventrals.

In a third tribe the snout is short, and the mouth cleft obliquely.

CEPOLA §, Lin.

The Ribband Fishes have a long dorsal and anal, both reaching to the base of the caudal, which is tolerably large; the cranium is not at all elevated; snout very short; lower jaw curved upwards; the teeth prominent, and the ventrals sufficiently developed. There are but two or three non-articulated rays in the dorsal, which are as flexible as the others; the

* It is the *Regalecus glesne*, Ascanius, Ic. Fasc. II, pl. xi, which he afterwards named *Ophidium glesne*, Mem. Scient. Soc. Copenh. III, p. 419, or the *Regalicus remipes*, Brunnich, Ib. pl. B, f. 4 and 5 Bloch, Syst. pl. 88, copies and alters the figure of Ascanius. A better copy is, Encycl. Method. f. 358.

† *Gymnetrus Grilli*, Lindroth, New Stockh. Mem. XIX, pl. viii.

‡ *Gymnetrus Russelii*, Shaw, IV, part II, page 195, pl. 28.

Add, the *Gymnetrus Hawkenii*, if the figure be correct; but the *Regalec lancéolé*, or *Ophidie chinoise*, Lacép. I, xxii, 3, or the *Gymnetrus cepedianus*, Shaw, does not belong to this genus.

§ This name of CEPOLA, given by Willoughby as a Roman synonyme of the *Fierasfer*, has been applied by Linn. to the present genus, to which the *Fierasfer* does not belong.

spine of the ventrals is alone stiff and sharp; there are six rays in the branchiæ, and the abdominal cavity is very short as well as the stomach; they have some cæca, with a natatory bladder which extends into the base of the tail.

Cep. rubescens, L.; Lin. Trans. VII, xvii, and Bl. 170, under the false name of *Cep. tænia**, the Ribband, or Red-band Fish. A Mediterranean species of a reddish colour.

LOPHOTES, *Giorna*,

Have the head surmounted with a high osseous crest; to its summit a long and stout spine is articulated, bordered behind with a membrane, and originating from this spine a low fin, whose rays are nearly all simple, extending equally to the point of the tail, which has a distinct but very small caudal; an extremely short anal beneath that point; moderate pectorals, beneath which are scarcely perceptible ventrals, composed of four or five excessively small rays. The teeth are pointed and not crowded; the mouth is directed upwards, and the eye very large. There are six rays in the branchiæ, and the abdominal cavity occupies nearly the whole length of the body.

L. cepedianus, Giorna, Mem. of the Imp. Acad. of Turin, 1805, 1808, p. 19, pl. 2. The only species known; it is found, though rarely, in the Mediterranean, and becomes very large†.

A Ninth Family of Acanthopterygians,

FAMILY IX.

THEUTYES.

The Theutides is as closely allied to the Scomberoides as the preceding one, and in other points, such as the armature, which is found in several genera on the sides of the tail, or in others, the horizontal spine before the dorsal, &c. It contains but very few genera; they are all foreign, and have a compressed, oblong body, a small mouth, but slightly or not at all protractile, each jaw of which is armed with a single range of trenchant teeth; palate and tongue without teeth, and a single dorsal. They are herbivorous fishes, feeding on fucus and other marine plants; their intestines are very large.

SIGANUS, *Forsk.*—BURO, *Commer.*—CENTROGASTER, *Houttuyn.*
—AMPHACANTHUS, *Bloch.*

The Sidjans have a remarkable character—unique, in ichthyology—in their ventrals, which are furnished with two spinous rays, one external,

* Add, the *Cepola japonica*, Krusenst, Voy. pl. lx, f. i.

† The description of Giorna is imperfect, because he only had a mutilated specimen, of whose origin he was ignorant. I drew mine from an individual more than four feet in length, taken at Genoa. See An. Mus. XX, xvii.

the other internal, the three intermediate ones branching as usual. They have five branchial rays, and a horizontal spine before the dorsal. The styloid bones of their shoulder lengthen out in a curve, so as to unite themselves by their extremities to the first interspinal of the anal*.

Numerous species are found in the Indian Ocean†.

ACANTHURUS, Lacép. and Bl.—HARPURUS, Forst.

These fishes, vulgarly called *Surgeons*, have the teeth trenchant and notched; a strong moveable spine on each side of the tail, that is as sharp as a lancet, and inflicts severe wounds on those who carelessly handle these fishes; hence their vulgar name. They inhabit the hot parts of both oceans‡.

The dorsal of some species is very high§.

Some have a sort of brush composed of stiff hairs, before the lateral spine||.

In others again the teeth are deeply notched, or pectinated on one side¶. The

PRIONURUS, Lacép.

Only differ from the preceding genus in the armature of the sides of the tail, which consists of a series of fixed, horizontal, and trenchant blades**.

NASEUS, Commers.—MONOCEROS, Bl. Schn.

Have, like the preceding, the sides of the tail armed with fixed trenchant blades: but the teeth are conical, and the front projects in a kind of horn or knob above the muzzle; but four rays in the branchiæ, and three soft ones in the ventrals; the skin resembles leather††.

* Geoff. Phil. Anat. I, 471, and pl. ix, f. 108.

† *Theutis javus*, L., Gronov. Zoophyl. pl. VIII, f. 4;—*Siganus stellatus*, Forsk.;—*Amphac. punctatus*, Bl. Schn., or *Acanthurus meleagris*, Shaw;—*Buro brunneus*, Commers., Lacép. V, 421;—*Siganus rivulatus*, Forsk.;—*Amphac. nebulosus*, Quoy and Gaym. Zool. Voy. Freycin. p. 369;—*Centrogaster fuscescens*, Houttuyn;—*Chatodon guttatus*, Bl. 196;—*Amph. marmoratus*, Quoy and Gaym. Voy. Freycin. Zool. pl. 62, f. 1 and 2;—*Amph. magnihac*, Ib. f. 3;—*Centrogaster argentatus*, Houtt., and several others to be described in our Ichthyology.

‡ *Chatodon chirurgus*, Bl. 208;—*Theutis hepatus*, L.; Seb. III, xxxiii, f. 3;—*Ac. glauco pareius*, Cuv., Seb. III, xxv, 3, which appears to be the true *Chatodon nigricans*, L.;—*Chat. triostegus*, Brousson., Dec. Ichth. No. 4, or *Acanthure zèbre*, Lacép., which is also his *Chat. zèbre*, III, xxv, 3;—*Ac. guttatus*, Bl., Schn.;—*Ac. suillus*, Cuv., Renard, I, pl. xiv, f. 82;—*Chat. lineatus*, L.; Seb. III, xxv, 1;—*Chat. Achilles*, Broussonet;—*Chat. meta*, Russ. 82;—*Chat. sohal*, Forsk., of which Lacép. has very improperly made a genus under the name of *Apisurus*;—*Ac. striatus*, Cuv.; *Paningu*, Renard, pl. 1, f. 8;—*Ac. argenté*, Quoy and Gaym. Voy. Freycin., p. 63, f. 3;—*Chat. nigrofuscus*, Forsk.;—*Chat. nigricans*, Bl. 203, which is not that of Linnæus.

§ *Ac. velifer*, Bl. 427.

|| *Ac. scopas*, Cuv., Renard, I, pl. xi, 101.

¶ *Ac. ctenodon*, Cuv., a new species.

** *Prionure microlépidote*, Lacép. An. Mus. IV, p. 205;—*Acanthurus scalprum*, Langsdorf.

†† *Naseus fronticornis*, Cuv., Lacép. III, vii, 2, Bl., Schn., pl. 42, Hasseq., it. pal. 332;—*Nas. tandock*, Ren. I, iv, 23; Valent. 518;—*Chat. unicornis*, Forsk., differ from our first species.—*Nas. brevirostris*, Cuv., Ren. I, xxiv, 130;—*Nas. tumifrons*, Cuv., badly drawn, Ren. I, 178;—*Nas. incornis*, Cuv., Ren. I, f. 128, and not so well, f. 147,

AXINURUS, Cuv.

More elongated than the preceding, and without horn or knob, but with the same branchial and ventral rays as in the preceding genus; each side of the tail armed with a single, square, trenchant blade, without a shield; the mouth very small, and the teeth very slender*.

PRIODON, Cuv.

Combine the notched teeth of *Acanthurus*, the three soft ventral rays of *Naseus*, and the unarmed tail of the *Sidjans*†.



FAMILY X.

The tenth family of Acanthopterygians comprehends a small number of genera, distinguished by

LABYRINTHIFORM PHARYNGEALS,

That is to say, that part of their superior pharyngeals is divided into small irregular lamellæ, more or less numerous, intercepting small cells, in which they have the power of retaining water for the purpose of being used in moistening the gills when the animal is on shore—an apparatus by which it is enabled to quit the pool or rivulet, which constitutes its usual element, and crawl to a considerable distance from it, a singular property, not unknown to the antients‡, and which induces the people of India to believe that they fall from heaven.

ANABAS, Cuv.

It is in this genus that we find the greatest degree of complication in these labyrinths; the third pharyngeals, however, have teeth as if paved, and there are others behind the cranium. Their body is round and covered with strong scales, their head broad, muzzle short and obtuse, and mouth small; the lateral line is interrupted at its posterior third. The borders of their operculum, suboperculum, and interoperculum strongly dentated, but not that of the preoperculum. There are five rays in the

probably the *Acanthurus harpurus*, Shaw;—*Nas. carolinarum*, Quoy and Gaym. Zool. du Voyage de Freycin., pl. 63, f. 1;—*Nas. tuber*, Commers., or *Nason-Loupe*, Lacép. III, vii, 3, or *Acanthurus nasus*, Shaw, Renard, I, f. 79, Valent., No. 119 and 478.

* *Axinurus thymnoides*, Cuv., a new species brought by Quoy and Gaymard from New Guinea.

† *Priodon annularis*, Cuv., a new species brought from Timor by the same gentlemen.

‡ Theophrastus, in his treatise upon fishes which live out of water, speaks of small ones which leave their native streams for some time and then return to them, and says that they resemble *Mugils*.

branchiæ, and many spinous ones in the dorsal, and even in the anal. The stomach is moderate, rounded, and their pylorus has but three appendages. But one species is known.

An. testudineus, Cuv.*, called in Jamaica the *Paneiri* or *Tree-Climber*, highly celebrated because it not only leaves the water, but, according to Daldorf, even climbs up the shrubs on its banks; this latter assertion, however, is denied. Found throughout all India.

POLYACANTHUS, *Kuhl.*

Have their rays spinous, and more numerous than *Anabas*; the same mouth, scales, and interrupted lateral line; but neither of the opercula is dentated; the body is compressed, and there are four rays in the branchiæ; a narrow band of small, short, and crowded teeth in the jaws, but none in the palate; the branchial apparatus is more simple, and their pylorus has but two cæcal appendages.

Found in rivers, &c. throughout all India†. The

MACROPODUS, *Lacép.*

Only differ from *Polyacanthus* in a less extended dorsal, which terminates, as well as the caudal and the ventrals, in a slender point, more or less elongated. The anal is larger than the dorsal.

These also are fresh-water fishes, found in India and China‡.

HELOSTOMA, *Kuhl.*

In addition to the characters of *Polyacanthus*, the fishes of this genus have a small compressed mouth, so protractile that it has all the appearance of protruding and withdrawing between the suborbitals; their very small teeth are attached to the borders of the lips, and not to the jaws or palate: there are five rays in the gills. The arches of the branchiæ, on the side next to the mouth, are furnished with lamellæ, nearly similar to the external ones, which may also assist in the process of respiration§. Their stomach is small, and has but two pyloric appendages, but their intestine is very long; the natatory bladder is of a middling size, and its walls are thick.

OSPYROBENUS||, *Commers.*

Possess all the characters of *Polyacanthus*, but the forehead is somewhat concave; the anal larger than the dorsal, as in *Macropodus*; the suborbi-

* It is the *Amphiprion scansor*, Bl., Schn., p. 204 and 570, or *Perca scandens*, Daldorf, Lin. Trans. III, p. 62. It is also the *Anthias testudineus*, Bl., pl. 322, and the *Coius coboius*, Ham. Buchan, pl. xiii, f. 38.

† *Trichopodus colisa*, H. Buchan;—*Trich. bejeus*, Id. 118;—*Trich. cotra*, Id. 119;—*Tr. lalius*, Id. 120;—*Tr. sola*, Id. Ib.;—*Tr. chuna*, Id. 121;—*Trichogaster fasciatus*, Bl., Schn., pl. xxxvi, p. 164;—*Chaetodon chinensis*, Bl., pl. cccviii, f. 1.

‡ The *Macropode vert doré*, Lacép. III, xvi, 1, and a new and much more beautiful species with alternate red and green bands.

§ But one species is known (*Hel. temminckii*, Cuv.), from the Moluccas, which we shall minutely describe in our Ichthyology.

|| This name is derived from the Greek word *osphyrcmai*, *olfacio*, and was invented

tals and lower part of the preoperculum very delicately dentated; the first soft ray of the ventrals extremely long; six branchial rays and the body strongly compressed. A species of this genus originally from China.

Osphr. olfax, Commers.; the *Gourami*, Lacép. III, iii, 2, becomes as large as the Turbot, and is considered even more delicious. It was introduced into the ponds of the Isle of France, where it increases rapidly, and has been taken thence a short time since to Cayenne. The female is said to dig a cavity in the sand for the reception of her eggs. The

TRICHOPODUS, Lacép.

Differ from *Osphromenus* in having a more convex forehead, and a shorter dorsal, besides which there are but four rays in the branchiæ; the first soft ray of their ventrals is also very long.

There is but one species known; a small fish of the Moluccas, marked with a black spot on the side*.

SPIROBRANCHUS, Cuv.

Possess the general form of *Anabas*, but the opercula are not dentated; the operculum merely terminating in two points; a series of palatine teeth.

Sp. capensis, Cuv. A diminutive fresh-water fish from the Cape of Good Hope; the only species known. The

OPHICEPHALUS, Bl.

Resemble all the preceding genera in most of their characters, and particularly in the cellular conformation of the pharyngeals, which are adapted to retain water. These fishes also creep to a considerable distance from their ordinary abodes, but what particularly distinguishes, and even separates, them from all other Acanthopterygians, is the absence of spines in the fins, the first ray of their ventrals at most excepted, and even that, though simple, is not sharp and stiff. Their body is elongated and almost cylindrical; their muzzle short and obtuse; their head depressed and furnished above with scales, or rather polygonal plates, as in *Anabas*, &c. There are five rays in their branchiæ; the dorsal occupies nearly their whole length, the anal also is very long, the caudal rounded, the pectorals and ventrals moderate, and the lateral line uninterrupted. Their stomach is shaped like an obtuse sac; two tolerably long cæcums adhere to the pylorus. The abdominal cavity extends above the anal, close to the end of the tail. All the jugglers of India exhibit this fish out of water for the diversion of spectators, and even the children amuse themselves by forcing it to crawl upon the ground. In the markets of China the larger

by Commerson, who conjectured that the hollow pharyngeals visible in this fish, as in others of the family, might be organs of smell, a kind of æthmoides.

N. B. The *Osphromene gal.*, Lacép., *Scarus gallus*, Forsk., is a *Julis*, Cuv.; but we have two new species of true *Ophromeni*, *Ophr. notatus*, and the *vittatus*, Cuv.

* It is the *Labrus trichopterus*, Gmel., Pall., Spic., Fasc. VIII, p. 45; the *Trichopterus Pallasii*, Shaw, IV, part II, p. 392; the *Trichogaster trichopterus*, Bl., Schn., and the *Trichopode trichoptère*, Lacép. N. B. The *Trichopode mentonnier*, Lacgr., or *T. satyrus*, Shaw, vol. IV, part II, p. 391, only rests upon a bad figure of *Gourami*.

species are sliced alive for consumption*. They may be divided by the number of their dorsal rays. Some have but thirty odd of these rays†. Others forty odd‡. Some again have more than fifty§.

FAMILY XI.

MUGILOIDES.

The Mugiloides constitute the eleventh family of the Acanthopterygians, and is composed of the genus

MUGIL, *Lin.*

The Mulletts, which may virtually be considered as a distinct family, so many peculiarities do they offer in their organization; their body is almost cylindrical, covered with large scales, and furnished with two separate dorsals, the first of which has but four spinous rays; the ventrals are inserted a little behind the pectorals. There are six rays in the branchiæ; their head is somewhat depressed, and covered with large scales or polygonal plates, their muzzle very short. Their transverse mouth forms an angle, by means of a prominence in the middle of the lower jaw, which corresponds with a depression in the upper one, the teeth being excessively tenuous, and frequently almost imperceptible. Their pharyngeal bones, highly developed, give an angular form to the opening of the œsophagus, similar to that of the mouth, which only permits fluids or very small matters to pass into the stomach, notwithstanding which this stomach terminates in a sort of fleshy gizzard, analogous to that of Birds: they have but few pyloric appendages, but the intestine is long and doubled.

They are capital fish, resort to the mouths of rivers in large troops, and are continually making great leaps out of the water; the European seas produce several species hitherto very imperfectly ascertained||.

M. cephalus, Cuv. (The Common Mullet). Distinguished from all the other species of Europe by its eyes, which are half covered by two adipose veils, adhering to the anterior and posterior edge of the orbit; by the fact, that when the mouth is closed, the maxillary is completely hidden under the sub-orbital; and by the base of the

* This is most incontestibly the genus alluded to by Theophrastus.

† *Ophicephalus punctatus*, Bl., or *Oph. lata*, Buchan.;—*O. marginatus*, Cuv., or *O. gachua*, Buchan.? pl. xxi, f. 21, or *Cor. motta*, Russel, II, pl. 164;—*O. auranticus*, Buch.

‡ *Ophicephalus striatus*, Bl. 359, or *Muttah*, Russel, pl. 162, or *O. chena*, Buch.? — *O. sola*, Id.;—*O. sowara*, Russ. 163.

§ *Ophicephalus murulius*, Buch., which is the *Bostrichoïde œillé*, Lacép. II, xiv, 3; — *Oph. barca*, Buch. xxxv, 20, to which the *Bostriche tacheté*, Lacép. III, p. 143, is at least very closely allied, and several new species to be described in our Ichthyology.

|| Linnæus and several of his successors have confounded all the European Mulletts under a single species, their *Mugil cephalus*.

pectoral being surmounted by a long and carinated crest. The nasal openings are separated from each other, and the teeth are tolerably prominent. It is the largest and best of the Mediterranean species. We have not seen it on the Atlantic coast of Europe, but its characters are visible in several species of India and of America*. Another species, nearly as large, and common to the Mediterranean and the ocean, is the

M. capito, Cuv.; the *Ramado* of Nice. It has the maxillary visible behind the commissure of the jaws even when the mouth is closed; much weaker teeth; nasal orifices approximated; the skin of the edges of the orbit not extending to the globe of the eye; the sur-pectoral scale short and obtuse; a black spot at the base of the latter fin†.

Two smaller species, *M. auratus*, and *M. saltator*, (the *M. doré*, and *M. sauteur*, of Risso), approach the *capito*; the maxillary of the first is hidden under the sub-orbital as in the *cephalus*, but the nasal orifices are approximated as in the *capito*; the other, with the characters of the *capito*, has an emarginated sub-orbital which allows the end of the jaw to be seen‡. A third large species, also common to both seas, is the

M. chelo, Cuv. (The Great-lipped Mullet). Particularly distinguished by its extremely bulky fleshy lips, whose edges are ciliated, and by teeth which dip into their substance like so many hairs; the maxillary is recurved, and shows itself behind the commissure.

M. labeo, Cuv., a small Mediterranean species, has, in proportion to its size, still larger lips, with crenated borders. Several of these thick-lipped species are found in the Indian Ocean§. The

TETRAGONURUS, *Risso*,

So called from the two salient crests that are found on each side near the base of the caudal, form another of these insulated genera, which seem to be representatives of particular families. These fishes are partly allied to the Mulllets, and partly to the Scomberoides. Their body is elongated; their spinous dorsal long, but very low, the soft one approximated to it,

* America produces five or six species badly characterized and confounded by Linn., under the name of *M. albulæ*. Among the number is the *M. Plumieri*, Bl., become a *Sphyræna* in Bl. Schn. p. 110, and the *M. lineatus*, Mitch. The true *cephalus* of the Mediterranean is found on the whole African coast. Add, of species from India, the *Bontah*, Russel, II, 180, or the *M. cur*, of Forsk., perhaps the same as our *cephalus*;—the *Kunnesee*, Id. 181;—*M. corsula*, Buch. pl. ix, 97.

† This appears to us to be the species particularly described by Willoughby, and figured by Pennant.

‡ Add, the *M. christian*, Voy. Freycin.;—*M. Ferrandi*, Ib.;—*M. parsia*, Buch. pl. xvii, f. 71;—*M. carcasia*, Id.;—*M. peradak*, Cuv., Russ. 182.

§ *M. crenilabis*, Forsk.;—*M. cirrhostomus*, Forst. App. Bl. Schn. 121.

N.B. The *M. cœruleo-maculatus*, Lacép. V, 389, the same represented under the name of *crenilabis*, pl. xiii, f. 1, belongs to the same group as the *capito*. The *Mugil appendiculatus*, Bosc., or *Mugilomore Anne-Caroline*, Lacép. V, 398, is nothing else than the *elops*, which is also the fact as respects the *Mugil salmonæus*, Forst., Bl. Schn. 121;—*Mugil cinereus*, Walbaum, Catesb. II, xi, 2, is a Gerres;—the *M. chanos*, Forsk., belongs to the Cyprinidæ.

short but higher, and the anal corresponding to the latter; the ventrals are a little distance behind the pectorals. The branches of the lower jaw raised vertically, and provided with a range of transparent pointed teeth, forming a kind of saw, and enclosed, when the mouth is shut, by those of the upper one. There is also a small series of pointed teeth in each palatine, and two in the vomer. Their stomach is fleshy and doubled, their cæcums numerous, and their intestines considerable. The œsophagus is furnished internally with hard and pointed papillæ.

Tetrag. Cuvieri, Risso; *Courpata* or *Corbeau*, of the Mediterranean coast, is the only species known, and is never taken except in very deep water. It is a foot long, and black; the scales hard, deeply striate and indented. The flesh is said to be poisonous*.

I also place here, between the *Mugiloides* and the *Gobioides*, a genus which does not completely harmonize with any other. I mean the

ATHERINA, *Lin.*,

Which have the body elongated; two dorsals widely separated; the ventrals further back than the pectorals; the mouth highly protractile, and furnished with very minute teeth; a broad silvery band along each flank on all the known species. There are six rays in the branchiæ; the stomach has no cul-de-sac, and their duodenum no cæcal appendages. The transverse processes of the last abdominal vertebræ are bent, and thus form a little conical bag or cornet, which receives the point of the natatory bladder. These little fishes are highly esteemed for the delicacy of their flesh. The young ones remain for a long time in compact troops, and are consumed on the coast of the Mediterranean under the name of *Nonnat*, the *Aphyes* of the antients. Several species inhabit European seas, hitherto confounded with the *Ath. hepsetus*, L.

Ath. hepsetus, Cuv.†; the *Sauclet* of Languedoc, or *Cabassous* of Provence; Rondel. 216; Duham. Sect. VI, pl. iv, f. 3. The head somewhat pointed; nine spinous rays in the first dorsal; eleven soft ones in the second, and twelve in the anal; fifty-five vertebræ in all.

Ath. Boyer, Risso; the *Joel* of Languedoc, or *Cabassouda* of Ivica, Rondel. 217. The head broader and shorter, the eye larger; seven spines in the first dorsal, eleven rays in the second, thirteen in the anal; forty-four vertebræ in all.

Ath. mochon, Cuv. (The *Mochon* of Ivica). The form of the *Sauclet*; but there are seven spines in the first dorsal, fifteen soft rays in the anal, and forty-six vertebra.

Ath. presbyter, Cuv.; the *Pretré*, *Abusseau*, or *Proseré* of the Coasts, &c.‡; Duham. Sect. VI, pl. iv, f. 1, 2, 3, 4, 6, 7. The

* There is no good figure of it: *Mugil niger*, Rondel. 423; *Corvus niloticus*, Aldrov. Pisc. 610; Risso, Ed. I, pl. x, f. 37.

† This is probably the special type of the *hepsetus* of Linnæus. It is necessary to observe, that the figure called *Atherina hepsetus*, Bl. pl. cccxciii, f. 3, and Syst. pl. xxix, f. 2, is purely ideal.

‡ So called from the silvery band on the flank, which has been compared to a stole.

muzzle a little shorter than that of the Sauclet; eight spines in the first dorsal, twelve soft rays in the second, fifteen or sixteen in the anal, and fifty vertebrae.

The Atherinæ foreign to Europe are numerous*.

The twelfth family of the Acanthopterygians, or that of

FAMILY XII.

GOBIOIDES.

The Gobioides are recognized by the dorsal spines being thin and flexible. All these fishes have about the same kind of intestines, that is, a large uniform intestinal canal without cæca, and no natatory bladder.

BLENNIUS, *Lin.*

The Blennies have a strongly marked character in their ventral fins, which are placed before the pectorals, and consist of only two rays. The stomach is slender, and has no cul-de-sac, the intestine large but without a cæcum, and there is no natatory bladder. The body is elongated and compressed, and has but a single dorsal, almost entirely composed of simple but flexible rays. They live in small troops among the rocks on the coast, leaping and playing, and are capable of living without water for some time. A slimy mucus is smeared over their skin, to which they owe their Greek name of *Blennius* (*a*), and their French name *Baveuses*. Several are viviparous, and there is a tubercle near the anus of all of them, and in both sexes, which appears destined for the purposes of coition. We divide them as follows:

BLENNIUS, *Cuv.*

The Blennies, properly so called, whose long, equal, and closely set teeth, form but a single and regular range in each jaw, terminated behind, in some species, by a longer and hooked tooth. The head is obtuse, the muzzle short, and the forehead vertical; the intestines broad and short. Most of them have a fimbriated appendage on each brow, and several have another on each temple. Several species of this subdivision are taken along the coast of France; one of the most remarkable is the

Bl. ocellaris, Bl. 167, 1. (The Ocellated Blenny). The dorsal bilobate, its anterior lobe elevated and marked with a round and black spot, surrounded with a white circle and a black one.

Bl. tentacularis, Brunn.; Bl. 167, 2, under the name *Bl. gatto-*

* *Ather. lacunosa*, Forst., Bl. Schn. 112, probably the *hepsetus* of Forsk. 69;—*A. endrachtensis*, Quoy and Gaym., Freycin. Zool. p. 334;—*A. Jacksoniana*, Id. 333;—*A. brasiliensis*, Id. 332;—*A. neso-galica*, Cuv., Lacép. V, pl. xi, f. 1, which is not the same as the *A. pinguis* of the text.—*A. manidia* of Lin., which is not, as he supposes, the *manidia* of Brown, Jam. pl. xlv, f. 3, but is the *A. notata*, Mitch. op. cit. I, pl. iv, f. 6; and several others to be described in our Ichthyology.

☞ (*a*) From the Greek word *blenna*, mucus from the nostrils.—ENG. ED.

rugine. The dorsal even, four filaments on the brows; a black spot between the fourth and fifth rays.

Bl. gattorugine, L.; Will. II, 2, and Bl. 162, 1, 2, (the Banded Blenny), under the name of *Bl. fasciatus*. But two filaments; dorsal almost even; marked with clouded and oblique brown bands.

Bl. palmicornis, Cuv.; Penn. Cop. Encycl. Method. f, 111, under the name of *gattorugine*. The dorsal even; the appendage over the eye fimbriated*.

The sur-ocular fimbriated appendages are hardly visible in others, but they have a membranous prominence on the vertex which dilates and becomes red in the nuptial season. Some of them are found in European seas. Such are,

Bl. galerita, L., Rondel. 204; *Bl. pavo*, Riss. The dorsal even; spotted and streaked with blue; a black ocellated spot behind the eye.

Bl. rubriceps, Riss. (The Red-headed Blenny). Three first rays of the dorsal elevated, forming a red point; top of the head of the same colour.

In others, again, the *PHOLIS* †, Arted., there is neither panache nor crest. One of them, a very small fish, is common on the coast of France.

Bl. pholis, L., Bl. 71, 2. (The Common Baveuse). Profile vertical; the dorsal slightly emarginate, dotted and marbled with brown and blackish.

We distinguish from these Blennies, properly so termed, under the name of

MYXODES, Cuv.,

Species with an elongated head, a pointed muzzle projecting in front of the mouth, and a single range of teeth, as in the Blennies, but without canines ‡; and under that of

SALARIAS, Cuv.,

Species whose teeth, also forming a single range and placed close to each other, are compressed laterally, hooked at the end, inexpressibly slender, and immensely numerous. They move, in the fresh state of the species, like the keys of a harpischord. Their head, strongly compressed above, is very broad below; their lips are thick and fleshy, their profile is completely vertical, and their spirally convoluted intestines are longer and thinner than in the common Blennies. The only species known are from the Indian Ocean §. We call

* Add, *Bl. cornutus*, L.;—*Bl. pilicornis*, Cuv., *pumaru*, Marcgr. 165, the second figure, but the first description, &c.

† *Pholis*, the Greek name of a fish always enveloped in mucus. Add, *Bl. cavernosus*, Schn. 37, 2;—*Gadus salarias*, Forsk. p. 22.

‡ The species are new.

§ *Sal. quadripinnis*, Cuv., which is the *Biennius gattorugine*, Forsk. p. 23;—*Bl. sinus*, Sujef. Act. Petrop. 1779, part II, pl. vi;—the *Alticus*, or *Saltator* of Commers., Lacép. II, p. 479, and several new species. I have every reason to believe that to

CLINUS*, Cuv.,

Those with short pointed teeth, scattered in several ranges, the first of which is the largest. Their muzzle is less obtuse than in the two preceding subgenera, their stomach wider and their intestines shorter.

In some, the first rays of the dorsal form a point separated by an emargination from the rest of the fin†; small fimbriated appendages on the eye-brows.

There are even some of them in which the first rays are altogether forward, and seem to form a pointed and radiated crest on the vertex‡.

In others, again, the dorsal is continuous and even§.

CIRRIBARBA, Cuv.,

Have, with the form of the Clinus, the teeth small and crowded, and, besides a little tentaculum over the eye and one on the nostril, there are three large ones at the end of the muzzle, and eight under the point of the lower jaw.

But one species is known, from India, of a uniform fawn colour.

MURÆNOIDES, Lacép.—CENTRONOTUS, Schn.

The Gonnelles have the ventrals still smaller than all the other Blennies, almost imperceptible, and frequently reduced to a single ray. Their head is very small, and their body elongated like a sword-blade; a dorsal, all of whose rays are simple and without articulation, extends along the whole length of the back. The teeth are like those of a Clinus, and their stomach and intestines of one uniform appearance.

Bl. gunnellus, L.; *Bl.* 71, 1; Lacép. II, xii, 2. Very abundant on the coast of France; there is a series of ocellated spots along the whole base of the dorsal.

OPISTOGNATHUS, Cuv.,

Have the form of the true Blennies, and particularly their short snout; distinguished by very large maxillaries prolonged behind into a kind of long, flat moustache; rasp-like teeth in each jaw, the external row strongest; three rays in the ventrals, which are placed exactly under the pectorals.

O. Sonnerati, Cuv., is the only species known; it was brought from the Indian Ocean by Sonnerat.

this subgenus we should also refer the *Bl. edentulus*, *Bl. Schn.*, or the *truncatus* of Forster, notwithstanding it is said to be without teeth.

* *Clinus*, the modern Greek term for the Blenny.

† *Bl. mustelaris*, L., Mus. Ad. Fred. xxxi, 3;—*Bl. superciliosus*, *Bl.* 168;—*Bl. argenteus*, Risso. N.B. The *Blennie pointillé*, Lacép. II, xii, 3, appears to me to be a badly preserved specimen of the *superciliosus*.

‡ *Bl. fenestratus*, Forst., *Bl. Schn.* p. 173.

§ *Bl. spadiceus*, Schn., Seb. III, xxx, f. 8;—*Bl. acuminatus*, Id., Seb. Ib. 1;—*Bl. punctatus*, Ott. Fabr. Soc. Hist. Nat. Copenh. vol. II, fasc. II, pl. x, f. 3;—*Bl. Audifredi*, Risso, pl. vi, f. 15;—*Bl. capensis*, Forster, *Bl. Schn.* 175;—*Bl. lumpenus*, Walb., Arted. Renov. part III, pl. iii.

We dare not separate, although they have no spinal ray, from the Blennies, the

ZOARCUS, Cuv.,

Which are provided with their anal tubercle; the intestines without cæca, and smooth oblong body, six rays in the branchiæ. There are three rays in the ventral; teeth conical, forming a single row on the sides of the jaws, and several in front; none in the palate; the dorsal, anal, and caudal, are united, not, however, until the dorsal is considerably depressed. There is in our seas, and particularly in the Northern ones, a species long known as viviparous; it is the

Z. viviparus; *Bl. viviparus*, L.; Bl. 72. A foot long; fawn-coloured, with blackish spots along the dorsal.

America has a considerably larger one,

Z. labrosus, Cuv.; *Bl. labrosus*, Mitch. Trans. New York, I, 1, 7. It is three feet and more in length; it is of an olive colour, sprinkled with brown spots.

ANARRHICHAS, Lin.*

The Wolf Fishes appear to me so very similar to the Blennies, that I would willingly name them *Blennies without ventrals*. The dorsal fin, entirely composed of simple, but not stiff rays, commences at the nape of the neck, and extends, as well as the anal, close to that of the tail, which is rounded, as well as the pectorals. Their whole body is smooth and slimy. Their palatine bones, vomer and mandibles, are armed with stout, bony tubercles, surmounted with small enamelled teeth, but the anterior ones are longer and more conical. This mode of dentition furnishes them with powerful weapons, which, added to their great size, render them ferocious and dangerous. They have six branchial rays; the stomach is short and fleshy; the pylorus being near its bottom, the intestine is short, thick, and without cæca, and they have no natatory bladder.

A. lupus, L., Bl. 74, (The Sea Wolf or Sea Cat), is the most common species; it inhabits northern seas, and is frequently seen on the coast of Europe; six or seven feet long; brown, with clouded bands of deep brown; the flesh resembling that of an eel. This fish is a substantial resource to the Icelanders, who salt and dry the flesh for food, employ the skin as shagreen, and the gall as soap†. The

GوبيUS, Lin.

Commonly called *Gobies* or *Sea-Gudgeons*, are instantly recognized by the union of their thoracic ventrals, either along the whole of their length, or at least at their base, forming a single hollow disk more or less infundibuliform. The spines of the dorsal are flexible, the branchial apertures provided with five rays only, and generally but slightly open. Like the

* *Anarrhichas*, Climber, a name invented by Gesner (Paralipomen, p. 1261), because this fish is said to climb upon rocks and shoals by the aid of its fins and tail.

† The petrified teeth of this fish have been considered as constituting *Bufonites*, but they have neither their form nor tissue.

Add, the *Anarr. minor*, Olafsen., Voy. en Isl. Fr. Trans., pl. L.

Blennies, they can live for some time out of water, their stomach has no cul-de-sac, and the intestinal canal is not furnished with cæca; finally, the males have the same little appendage behind the anus, and some species are known to be viviparous. They are small or moderate sized fishes, which live among the rocks near the shore. Most of them have a simple natatory bladder.

Gobius, *Lacép.* and *Schn.*

In the true Gobies the ventrals are united throughout their whole length, and even before their base by a traverse, so that they form a concave disk. The body is elongated; head moderate and rounded; cheeks inflated and the eyes approximated; two dorsal fins, the last of which is long. Several species inhabit the seas of Europe, whose characters are not yet sufficiently ascertained*.

They prefer a clayey bottom, where they pass the winter in canals which they excavate. In the spring they prepare a nest in some spot abounding with fucus, which they afterwards cover with roots of the *Zostera*; here the male remains shut up, and awaits the females, who successively arrive to deposit their eggs; he fecundates them, and exhibits much care and courage in defending and preserving them†.

G. niger, L.; Penn. Brit. Zool. pl. 38. (The Black or Common Goby). Body blackish-brown; dorsals bordered with whitish; the most common species on the coast of Europe. The extremities of the superior rays of the pectorals are free; length four or five inches.

G. jizzo, Bl. 107, f. 3. (The Blue Goby). Brown, marbled with blackish; blackish fins; two white lines on the first dorsal, whose rays are prolonged in filaments above the membrane.

G. minutus, L.; *Aphia*, Penn., pl. 37. (The White Goby). Body a pale fawn colour; fins whitish, transversely marked with fawn-coloured lines; length, from two to three inches.

The Mediterranean, which is perhaps inhabited by these three species, produces several others of different sizes and colours‡.

G. capito, Cuv.; Gesner, 396. (The Great Goby). Olive, marbled with blackish; lines of blackish points on the fins; the head broad and the cheeks inflated; length one foot and more.

G. cruentatus, Gmel. (The Bloody Goby). Tolerably large; brown, marbled with grey and red; lips and operculum marbled with

* Bélon and Rondelet have endeavoured to prove that this fish is the *Gobius* of the antients, and Artdi pretends to have found in the ocean the badly determined Mediterranean species of those authors. Hence has arisen a most inextricable confusion, to disentangle which it is necessary to recommence both descriptions and figures, a task we shall partially undertake in our Ichthyology.

† These observations were made by the late Olivi, on a Goby of the canals of Venice, which he considers identical with the *niger*, but which is perhaps another of the numerous Mediterranean species; they are given by M. de Martens in the second volume of his *Voy. to Venice*, p. 419. My conclusion is, that the Goby is the *Phycis* of the antients, "*the only fish that constructs a nest.*" Arist. Hist., lib. VIII, cap. xxx.

‡ See the descriptions, but without wholly adopting the nomenclature, of Risso, *Ich. de Nice*, p. 155, et seq.

a blood-red; red lines on the first dorsal; lines of salient points forming an H on the nape of the neck, &c.

Some species are also found in fresh water; such is the *Gob. fluviatilis*, observed by Bonelli in a lake in Piedmont, smaller than the *niger*, blackish, without the free pectoral filaments, and a black spot above the branchial aperture. A large one is obtained in the environs of Bologna, the *G. lota*, Cuv.; brown; blackish veins on the cheek; a little blackish spot on the base of the pectoral, and another on each side of that of the caudal.

Among the Gobies foreign to Europe, we may observe the *G. macrocephalus*; *Cottus macroceph.*, Pall., Nov. Act. Petrop., I, pl. x, f. 4, 5, 6, on account of the extreme length of its head. The *G. lanceolatus*, Bl. 33, 1; *G. bato*, Buch., pl. 37, f. 10; *Eleotris lanceolata*, Bl., Schn., pl. xv, which we call the *Gobius elongatus*, on account of their elongated form and pointed caudal*. The

GOBIOIDES, Lacép.

Only differ from the Gobies in the union of their dorsals, which form but one. Their body is more elongated†.

TÆNIOIDES, Lacép.

These, with the single dorsal of the Gobioides, have a still more elongated body. Their physiognomy is extremely singular; the upper jaw is very short; the lower, elevated and every where convex, ascends in front of it, both being armed with long hooked teeth; the eye is almost reduced to nothing, and is completely hidden under the skin. The cavity of the mouth is occupied by a fleshy and nearly globular tongue, and there are some small cirri beneath the lower jaw.

But one species is known, the *Tænioide Hermannien*, Lacép., which lives in the mud of ponds, in the East Indies‡.

Bloch, Schn., p. 63, very properly separates from the whole genus *Gobius* the

PERIOPHTALMUS, Schn.

Which have the entire head scaly; the eyes are brought quite together, and provided at their inferior edge with an eyelid which can be made to cover them, and the pectorals are covered with scales for more than half their length, which give them the appearance of being attached to a sort of upper limbs. Their gills being even narrower than those of other

* Among these species foreign to Europe, we may unhesitatingly place the *Gobius Plumieri*, Bl. 175, 3;—*G. lagocephalus*, Pall. VIII, pl. 11, f. 6, 7;—*G. Boddarti*, Id. Ib., pl. 1, f. 5;—*G. ocellaris*, Brouss. Dec., pl. 11;—*G. bosc*, Lacép. II, xvi, 1, or *G. viridus-pallidus*, Mitch. op. cit. I, 8, or *G. alepidotus*, Bl., Schn.;—*G. Russelii*, Cuv., Russ. I, 53;—*G. giuris*, Buchan., pl. xxxiii, f. 13; Russ. 1, 50;—*G. changua*, Buch. pl. V, f. 10;—the *Bostryche chinois*, Lacép. II, xiv, and many new species to be described in our Hist. des Poissons.

† *Gob. Broussonnet*, Lacép. II, pl. xvii, f. 1, (*Gob. oblongatus*, Schn.; add, 548).

‡ It is the *Capota cacula*, Bl., Schn., pl. liv, from a drawing by John; the *Tænioide Hermannien*, Lacép. II, xix, 1, from a Chinese drawing; and the *Gobioide rubicunda*, Buch., pl. v, f. 9.

Gobies, they can live out of water for a still longer period; and in the Moluccas, their native country, they are seen creeping and leaping over the mud, either to escape from their enemies, or to seize upon the small Shrimps, which constitute their chief food.

Some of them have the concave disc-like ventrals of the true Gobies*.

The ventrals of others are divided nearly to the base†.

I would also separate, as well as with Gronovius give the name of,

ELEOTRIS, Gronov.

To those Fishes, which, like the Gobies, have flexible spines in the first dorsal and the post-anal appendage, but whose ventrals are entirely distinct, the head obtuse and slightly depressed, the eyes at a distance from each other, and which have six rays in the branchial membrane. Their lateral line is but slightly marked, and their viscera are similar to those of the Gobies. Most of them inhabit fresh water, and frequently live in the mud.

E. dormitatrix, Cuv.; *Platycephalus dormitator*, Bl., Schn. (The Sleeper). Tolerably large, with a depressed head, inflated cheeks, and fins spotted with black. From the marshes of the Antilles‡.

They are also found in Senegal§, and in India||.

A small species is taken on the coast of the Mediterranean, *Gobius auratus*, Riss., of a golden colour, with a black spot on the base of the pectoral¶.

* *Gobius Schlosseri*, Pall., Spic. VIII, pl. 1, f. 1—4, to which must be added the *Gob. striatus*, Schn., xvi, left among the *Gobies*, though it is hard to say why, since it is a true *Periophthalmus*.

† *Gobius Kœlreuteri*, Pall., Spic. VIII, pl. 11, f. 13;—*Per. ruber*, Schn.;—*Per. papilio*, Schn., pl. xxv.

N. B. Both the *Gobies* and the *Periophthalmi* with divided ventrals, according to the system of M. de Lacépède, would be *Gobiomores*; if, together with this division of the ventrals, they had but one dorsal, they would be *Gobiomoioïdes*, but the species arranged under these two genera have not all their characters. The *Gob. Gronovii*, Gm., Marcgr. 153, does not belong to this family, it is our genus *NOMEUS* of the family of the *Scombroïdes*. The *Gobiomoroides pison*, *Gob. pisonis*, Gm., *Amore pixuma*, Marcgr. 166; *Eleotris*, 1, Gron., Mus. 16, has not the character of this genus; for it has two dorsals both in the fig. of Marcgr., and in the description of Gronovius; by its ventrals it is an *Eleotris*.

Bloch, Ed. Schn., p. 65, separates from the Gobies, and makes the genus *Eleotris* different from that of Gronovius, which bears the same name, of those species whose ventrals are merely united like a fan without being infundibuliform; but, in those which I have examined, the membrane which unites the external edges in front is merely somewhat shorter in proportion, which has prevented it from being observed, and for this reason I leave them among the Gobies.

‡ It is the *Gobiomore dormeur*, Lacép. Add, the *Guavina*, Parr., pl. xxxix, f. 1;—the *Amore guaçu*, Marcgr. 66;—the *Amore pixuma*, Id. Ib., or *Gob. pisonis*, Gm.

§ I infer this from a note attached to a dried skin presented to the Museum by Adanson, and which is specifically different from the preceding ones.

|| The *Gob. strigatus*, Brouss. Dec., pl. 1, or *Gobiomore taiboa*, Lacép. cop. Ency. Method., f. 138;—the *Eleotris noir*, Quoy and G., op. cit., pl. lx, f. 2, and the *Sciæna macrolepidota*, Bl. 298, and *maculata*, Id. 299, 2, which constituted my former genus *Prochilus*, which must be suppressed.

¶ It is an *Eleotris*, and not a Goby.

CALLIONYMUS*, *Lin.*

The Callionymes or Dragonets have two strongly marked characters: first, in their branchiæ having but a single aperture, consisting of a hole on each side of the nape: and, secondly, their ventrals, which are placed under the throat, are separate, and larger than the pectorals. Their head is oblong and depressed, their eyes approximated and directed upwards, their intermaxillaries very protractile, and their preopercula elongated behind, and terminating in some spines. Their teeth are small and crowded, but there are none in the palate. They are pretty fishes with a smooth skin, whose anterior dorsal, supported by a few setaceous rays, is sometimes very elevated. The second dorsal is elongated as well as the anal. They have the same post-anal appendage as the preceding ones. There is no cul de-sac to their stomach, and the natatory bladder and cæca are wanting. One of them is common in the British Channel, the

Call. lyra, L.; Bl. 161; Lacép. II, x, 1. (The Gemmeous Dragonet, the Savory, or Doucet). The first dorsal elevated, and the second ray extended into a long filament; orange spotted with violet. The *Call. dracunculus*, Bl. 162, only differs from it in the first dorsal being short and without the filament; several authors consider it the female. Some others are found in the Mediterranean, such as

Call. lacerta, Cuv. (The Lacert). Rond. 304, and not so well, *Call. pusillus*, Laroche, Ann. Mus. XIII, xxv, 16. First dorsal low; the second much elevated in the male; silvery points, and white, black-edged lines on the flanks; the caudal long and pointed †. The

TRICHONOTUS, *Schn.*

Appears to be a mere Callionymus with a very elongated body, whose single dorsal and anal have a corresponding length. The two first rays of the dorsal, extended into long setæ, represent the first dorsal of the common Callionymus. The branchiæ, however, are said to be considerably cleft ‡.

COMEPHORUS, *Lacép.*

Have the first dorsal very low; the muzzle oblong, broad, and depressed; gills much cleft, with seven rays; very long pectorals, and what constitutes their distinguishing character, a total absence of ventrals.

But one species is known, from Lake Baikal, the *Callionymus baicalensis*, Pall. Nov. Act. Petrop. I, ix. 1; a foot long, of a soft

* *Callionymus* (beautiful name), one of the names of the *Uranoscopus* among the Greeks. Linnæus applied it to the present genus.

† The *Call. diacanthus*, Carmich., Lin. Trans. XII, pl. xxvi, does not appear to me to belong to this genus. The *Call. indicus*, Lin., is nothing more than the *Platycephalus spatula*, Bl. 424. Add, *Call. cithara*, Cuv.;—*C. jaculus*, and other new Mediterranean species; and of species foreign to Europe, the *C. orientalis*, Schn., pl. vi; *C. ocellatus*, Pall. VIII, pl. iv, f. 13;—*C. sagitta*, Id. Ib., f. 4, 5; and some others to be described in our Ichthyology.

‡ *Trichonotus setigerus*, Bl., Schn., pl. 39.

fatty substance, from which oil is obtained by compression. It is only to be had when dead, after a storm.

PLATYPTERUS, *Kuhl and Van Hasselt.*

Have the broad and separated ventrals of a *Callionymus*; a short depressed head; the mouth small, and branchiæ open; scales broad; the two dorsals short and separated*.

It is with some hesitation that I close this family with a genus which will one day probably form the type of a separate family; I mean the

CHIRUS, *Stell.*—LABRAX, *Pall.*

Fishes with a tolerably long body, furnished with ciliated scales; a small unarmed head; slightly cleft mouth, provided with small, unequal, conical teeth, the spines of whose dorsal are almost always very delicate, the fin itself extending the whole length of the back; their distinguishing character consists in several series of pores, similar to the lateral line, or, as it were, in several lateral lines. There are no cæca to the intestines, and they frequently have an appendage on the eye-brow, as is the case with certain Blennies, but their ventrals consist of five soft rays, as usual. The species known are from the sea of Kamtschatka†.



FAMILY XIII.

I form, as the thirteenth family, the

PEDICULATED PECTORALES,

Out of certain Acanthopterygians, whose carpal bones are elongated so as to form a sort of arm, which supports their pectorals. It comprises two genera, which are closely approximated, although authors have generally placed them at a considerable distance from each other, and which are closely allied to the Gobioides.

LOPHIUS‡, *Lin.*

The Anglers have for their general character, independently of the semi-cartilaginous skeleton and the naked skin, the pectorals supported by

* *Platyptera melanocephala*, K. and V. H.; *Pl. trigonocephala*, Id.; two fishes from India to be described in our Ichthyology.

† *Labrax lagocephalus*;—*L. decagrammus*;—*L. superciliosus*;—*L. monopterygius*;—*L. octogrammus*;—*L. hexagrammus*; all described and figured by Pallas, Mem. Acad. Petersb., vol. XI, 1810.

‡ *Lophius*, a name made by Artedi, from *Lophia* (*pinna*), on account of the crests of their head. The antients called them *Batrachos*, and *Rana*, or Frog.

two arms, as it were, each of which is formed of two bones that have been compared to the radius and ulna, but which in reality belong to the carpus, and which in this genus are longer than in any other; in the ventrals being placed very far before these pectorals; in opercula and branchiostegous rays enveloped in the skin; and, finally, in the only opening of the gills being a hole situated behind the said pectorals. They are voracious fishes, with a wide stomach and short intestine, which survive a long time out of water, on account of the smallness of their branchial apertures.

LOPHIUS, Cuv.

The Anglers, properly so called, have the head excessively large in proportion to the rest of the body, very broad and depressed, and spinous in many places; the mouth deeply cleft and armed with pointed teeth; the lower jaw furnished with numerous cirri; two distinct dorsals, some rays of the first separated before and moveable on the head, where they rest on a horizontal interspinal; the branchial membrane forming a very large sac, opening in the axilla, and supported by six very long rays; the operculum small. There are but three branchiæ on each side. It is asserted that these fishes live in the mud, where, by agitating the rays of their head, they attract smaller ones, who take the often enlarged and fleshy extremities of those rays for worms, and thus become their victims; it is also said that they can seize or retain them in their branchial sac*. They have two very short cæca near the origin of the intestine, but no natatory bladder.

L. piscatorius, L.; Bl. 87; *Sea-Devil*; *Galanga*, &c. (The Common Angler, or Frog Fish). A large fish, of from four to five feet in length, inhabiting the seas of Europe, whose hideous figure has rendered it celebrated.

L. parvipinnis, Cuv. A very similar species, that is found in the same seas; its second dorsal, however, is lower, and it has only twenty-five vertebræ, while the *piscatorius* has thirty†.

CHIRONECTES.—ANTENNARIUS, Commers.

The Hand-Fishes have four rays on the head, as in the Anglers; the first of which is slender, and frequently terminating in a tuft; the succeeding ones, augmented by a membrane, are sometimes much enlarged, and at others united into a fin. The body and head are compressed; the mouth cleft vertically: the only opening of the branchiæ, which are furnished with four rays, is a canal and a small hole behind the pectoral; the dorsal occupies nearly the whole length of the back. The entire body is

* Geoff. Ann. du Mus. X, p. 180.

† We are ignorant whether it is the *Lophias budecassa* of M. Spinola and Risso or not, that species being described as more fawn-coloured and varied than the common one.

Add, the *Loph. setigerus*, Vahl, Soc. Hist. Nat. Copenh. IV, p. 215, and pl. iii, f. 5 and 6, improperly named *viviparus* by Bl., Syst., pl. xxxii.

N. B. The *Baudroye Ferguson*, Lacép., Phil. Trans. LIII, xiii; the *Lophius cornubicus* of Sh., Borlase, Corn. xxvii, 6; the *L. barbatus*, Gmel., Act. Stockh., 1779, 3rd Cah. fasc. III, pl. iv, are merely altered specimens of the *piscatorius*; the *L. monopterygius*, Shaw, Nat. Misc. 202 and 203, is a *Torpedo* disguised by the stuffer.

frequently provided with cutaneous appendages; there are four branchiæ; the natatory bladder is large, and the intestine moderate, and without cæca. These fishes, by filling their enormous stomachs with air, are enabled to expand their belly like a balloon; on land, their pairs of fins enable them to creep almost like small quadrupeds, the pectorals, from their position, performing the functions of hind feet, and thus they live out of water for two or three days. They are found in the seas of hot climates, and several of them were confounded by Linnæus under the name of *Lophius histrio* *.

We might distinguish those species in which the second and third rays are united in a fin, which is even sometimes joined to the second dorsal †.

MALTHE, Cuv.

The Beaked Anglers have the head excessively enlarged and flattened, chiefly by the projection and volume of the suboperculum; the eyes very much forwards; the snout salient, like a small horn; the mouth, beneath the snout, moderate and protractile; the branchiæ supported by six or seven rays, and opening on the dorsal surface by a hole above each pectoral: a single, small, and soft dorsal; the body studded with osseous tubercles; cirri on the whole length of its sides; but there are no free rays on the head. The cæca and natatory bladder are wanting ‡.

BATRACHUS, Bl. Schn.—BATRACOIDES, Lac. §

The head horizontally flattened, broader than the body; the mouth well cleft; operculum and suboperculum spinous; six branchial rays; the ventrals narrow, inserted under the throat, and formed of but three rays, the first of which is elongated and widened; pectorals supported by a short arm, the result of the elongation of the carpal bones. The first dorsal is short, and supported by three spinous rays; the second is soft and long, as well as that of the anus, which corresponds to it. The lips are frequently furnished with filaments. Those which have been dis-

* Species:—*Chiron. pictus*, Cuv., or *Lophius histrio-pictus*, Bl., Schn. 142, or Mém. Mus. III, xvi, 1;—*Ch. tumidus*, Cuv., Mus. Ad. Fred., p. 56;—*Ch. levigatus*, Cuv., or *L. gibbus*, Mitch. op. cit. I, vi, 9;—*Ch. marmoratus*, or *L. Hist. Marm.*, Bl., Schn. 142, Klein, Misc. III, 3, 4, or *L. raninus*, Tiles., Mém. Nat. Mosc. II, xvi;—*Ch. hispidus*, Bl., Schn. 143, Mém. Mus. III, xvii, 2;—*Ch. scaber*, Ib. XVI, 2, or *Guaperva*, Maregr. 150 (but not the figure), *L. histrio*, Bl., pl. cxi;—*Ch. biocellatus*, Cuv., Mém. Mus. III, xvii, 3;—*Ch. ocellatus*, or *L. histr. ocell.*, Bl., Schn. 143, Parra, 1;—*Ch. variegatus*, or *L. chironecte*, Lacép. I, xiv, 2, or *L. pictus*, Shaw, Gen. Zool. V, part II, pl. clxv;—*Ch. furcipilis*, Cuv. Mém. Mus. III, xvii, 1; Laet. Ind. Occ. 574, a figure given for the *guaperva*, Maregr. 150;—*Ch. nummifer*, Cuv. Mém. Mus. III, xvii, 4;—*Ch. Commerseui*, Cuv., Lacép. I, xiv, 3, and very badly, Ren. I, xliii, 212;—*Ch. tuberosus*, Cuv.

† *Ch. punctatus*, Cuv. Mém. Mus. III, xviii, 2, and Lacép. Ann. Mus. IV, lv, 3;—*Ch. unipinnis*, Cuv. Mém. Mus. III, xviii, 3, Lacép. Ann. Mus. III, xviii, 4.

‡ *Lophius vespertilio*, L., Bl. 110;—*Malth. nasuta*, Cuv., Seb. I, lxxiv, 2;—*M. notata*, Cuv.;—*M. angusta*, Cuv., the skeleton of which is found in Rosenthal, Pl. Ichth. t. XIX, 2;—*M. truncata*, Cuv.;—*M. stellata*, Cuv., or *Lophius stellatus*, Vahl., Mem. Soc. Hist. Nat. Copenh. IV, pl. iii, f. 3, 4, the same as the *Lophie faujas*, Lacép. I, xi, 2, 3, and the *Lophius ruber*, Til., Krusenstein's Voy. LXI.

§ *Batrachos*, frog, from their broad head.

sected present a stomach resembling an oblong sac, and short intestines, but there is no cæcum. The fore-part of the natatory bladder is deeply bifurcated. They keep themselves hidden in the sand, to surprise their prey, like the *Lophius*, &c.; the wounds inflicted by their spines are reputed dangerous. They are found in both oceans.

Some of them have a smooth and fungous skin, and a cutaneous appendage over the eye*.

Others are covered with scales, and have no appendage over the eye†.

We might distinguish those in which the scales and cirri are wanting, but which have lines of pores pierced in the skin‡, and hooked teeth in the lower jaw.

The fourteenth family of the Acanthopterygians, or that of

FAMILY XIV.

LABROIDES,

Is easily recognized; the body is oblong and scaly; a single dorsal is supported in front by spines, each of which is generally furnished with a membranous appendage; the jaws are covered with fleshy lips; there are three pharyngeals, two upper ones attached to the cranium, and a large lower one, all three armed with teeth, now as if paved, and then pointed or laminiform, but generally stronger than usual; an intestinal canal either without cæca, or with two very small ones, and a strong natatory bladder.

LABRUS, *Lin.*,

Form a very numerous genus of fishes, which strongly resemble each other in their oblong form; their double fleshy lips, from which they derive their name, one adhering immediately to the jaws, and the other to the suborbitals; their crowded branchiæ with five rays; their conical maxillary teeth, the middle and anterior of which are the longest, and their cylindrical and blunt pharyngeal teeth arranged as if paved, the upper ones on two large plates, the lower on a single one which corresponds to the two others. Their stomach does not form a cul-de-sac, but is continuous with an intestine without cæca, which, after two inflexions, terminates in a large rectum. They have a single and strong natatory bladder.

* *Batr. tau* (*Gadus tau*, L.), or *Lophius bufo*, Mitch., or *Batrachioide verneul*, Lesueur, Mém. Mus. V, xvii;—*Batr. varié*, Id. Ac. Nat. Sc. Phil.;—*Batr. grunniens*, (*Cottus grunniens*, L.), Bl. 179, Seb. III, xxiii, 4;—*Batr. gangene*, Buch. XIV, 8;—*Batr. dubius*, Cuv., or *L. dubius*, J. White, 265, Nieuhof, Ap., Will. Ap. IV. 1;—*Batr. 4-spinis*, Cuv., or *Batr. diemensis*, Lesueur, Ac. Nat. Sc. Philad.

† *Batr. surinamensis*, Bl. Schn. pl. vii, given as the *Tau*, Lacép. II, xii, 1;—*B. conspicillum*, Cuv., or the pretended *Batr. tau*, Bl. pl. lxvii, f. 2 and 3.

‡ *Batr. porosissimus*, Cuv., *Niqui*, Marcgr. 178, or the second *Niqui* of Pison, 295. N.B. The first *Niqui* of Pison, 294, is a badly copied figure from the collection called Mentzel's, to which the engraver has added scales.

LABRUS, properly so called, and vulgarly, OLD WOMEN OF THE SEA, Have the opercula and preopercula without spines or dentations; the cheek and operculum covered with scales; the lateral line straight, or nearly so. The seas of Europe produce several species, the variation of whose colours rarely allows them to be clearly distinguished*.

L. maculatus, Duham. Sect. IV, pl. ii, f. 1; *Lab. maculatus*, Bl. 284? *Lab. bergilta*, Ascan. Ic. I. From a foot to eighteen inches in length; twenty or twenty-one dorsal spines; blue or greenish above, white beneath; every where chequered with fawn-colour, which sometimes becomes general†.

L. variegatus, Gm.; *L. lineatus*, Penn. XLV, cop. Encycl. 402. One or more clouded, irregular, dark bands along the flank, on a ground more or less reddish; sixteen or seventeen spines in the dorsal, which is marked with a dark spot in front‡.

L. carneus, Bl.; *L. trimaculatus*, L., Bl. 289. Reddish; three black spots on the hind part of the back.

L. turdus, Gm.; Salvian. 87. Green, more or less deep; scattered spots sometimes resembling mother-of-pearl, sometimes brown; frequently a mother-of-pearl band along the flank§.

L. merula, Gm.; Salvian. 87. Black, more or less bluish; the dorsal of these three species contains from sixteen to eighteen spines. The last one is only obtained from the Mediterranean||.

CHEILINUS, Lacép.

The Cheilines differ from *Labrus*, properly so called, in the interruption of the lateral line opposite the end of the dorsal; it recommences a little lower down. The scales on the end of the tail are large, and somewhat envelope the base of the caudal. They are beautiful fishes from the Indian Ocean¶.

* With respect to these fishes we can neither trust to the figures of Bloch, nor to the description of Gmelin.

† The *Vieille tachetée* was indicated by Lacép., under the name of *Labre neustrien*. It is possible that the *Labrus maculatus*, Bl. 294, was a bad figure of it, taken from a dried specimen whose colours had been entirely changed; the *Labrus tinca*, Shaw, Nat. Misc. 426, and Gen. Zool. IV, pl. ii, p. 499, is a beautiful variety, red spotted with white, but is not the *tinca* of Lin.; the *Lab. ballan*, Penn. 44, cop. Encyl. 400, is the fawn-coloured variety; the *L. comber*, Penn. XLII, cop. Encycl. 405, is a red variety, with a suite of white spots along the flank.

‡ The only good drawing of this fish is that of Pennant; I suspect the *Labr. vetula*, Bl. 293, to be an altered figure of the same; it is, in the nuptial season, the *Turdus perbellæ pictus*, of Willoughb. 322, and the *Sparus formosus*, Shaw, Nat. Misc.

§ I am of the opinion that the *Lab. viridis*, and the *Lab. luscus*, Lin., are varieties of this *Turdus*, which is subject to great changes of colour. The *Lab. viridis*, Bl. 282, is a Julis, Cuv., and differs from that of Linnæus.

|| Add, *Lab. americanus*, Bl. Schn., or *Tautoga*, Mitch. pl. iii, 1;—*L. herissé*, Lacép. III, xx, 1;—*L. large queue*, Id. III, ix, 3;—*L. deux croissants*, Id. III, xxxii, 2;—*L. Diane*, Id. III, 1.

N. B. *Cheilion doré*, the *Cheil. auratus*, Commers., Lacép. IV, 433, or the *Labrus inermis*, of Forsk. (*L. Hassee*, Lacép.), and Voy. Freycin. Zool. pl. 54, No. 2, is merely a very slender *Labrus* with flexible dorsal spines.

¶ The *Cheiline trilobé*, Lacép. III, xxxi, 3, the same as the *Sparus chlorurus*, Bl. 260;—*Sparus radiatus*, Bl. Schn. 56;—*Sparus fasciatus*, Bl. 257, which is also the

LACHNOLAIMUS, Cuv.

The Captains have the general character of a true *Labrus*, but the pharyngeals have not the teeth as if paved, except at their posterior part, the remainder of their extent, as well as a part of the palate, being covered with a villous membrane. These fishes are recognized at sight by the first spines of their dorsal, which rise in long flexible filaments. The species known are from America*.

JULIS, Cuv.

The Girelles have the head entirely smooth and without scales; the lateral line forming an elbow opposite the end of the dorsal. Some species are found in the seas of Europe.

J. vulgaris; *Labius julis*, L., Bl. 287, f. 1. (The Girelle). A small fish remarkable for its beautiful violet hue, relieved on each side by a zigzag line of a rich orange colour, &c. It varies greatly, is the best known of the Mediterranean species, and is also found in the ocean.

J. Gioffredi, Risso. (The Red Girelle). A fine scarlet; a black spot at the angle of the operculum; a gilt band along the flanks; inhabits both the Mediterranean and the ocean.

J. turcica, Risso. (The Turquoise Girelle). A rich green; a red streak on each scale; the head red, with blue lines; one or more vertical bands of a turquoise blue; a black spot on the pectoral; tail shaped like a crescent; one of the most beautiful fishes of the Mediterranean.

Hot climates produce numerous species of this fish, most of which are splendidly and variously coloured.

Some of them have a rounded or truncated caudal†; the first dorsal rays of others‡ are drawn out into filaments.

Labre enneacanthé, Lacép. III, p. 490;—*Labrus fasciatus*, Bl. 290, which is also the *Labre malapteronote*, Lacép. III, xxxi, 1; the figure to which should be referred the description of the *Labre fuligineux*, Id. III, p. 493, but not the fig., which is that of the *Mesoprion uninotatus*;—*Labrus melagaster*, Bl. 296, 1;—*L. diagramme*, Lacép. III, 1, 2;—*L. lunula*, Forsk. N.B. The *Labrus scarus*, L., (*Cheiline scare*, Lacép.), was merely established by Artedi and Linnæus on an equivocal description of Bêlon, Aquat. lat. ed. p. 239, and Obs. p. 21, where it is impossible to ascertain even the genus of the fish of which he speaks. The fig. and description of Rondelet, Lib. VI, cap. II, p. 164, usually quoted with those of Bêlon, refer to a totally different fish of the genus *Sparus*. The true *Scarus* of the Greeks is another fish, as we shall soon see.

* *Lachnolaimus suillus*, Cuv.; Catesb. II, xv;—*L. caninus*, Cuv., Parra, pl. iii, f. 2.

† Species with a round or truncated tail; *Labre parterre*, Lacép. III, xxix, 2, the same as the *Echiquier*, Id. p. 493;—*L. trilobé*, Id. III, iv, 3;—*L. tenioure*, Lac. III, xxix, 1, the same as his *Spare hémisphère*, III, xv, 3, and probably as his *Spare brachion*, III, xviii, 3;—*L. ceinture*, Id. III, xxviii, 1;—*L. brasiliensis*, Bl. 280;—*L. macrolepidotus*, Bl. 284, 2;—*L. guttatus*, Bl. 287, 2;—*L. cyanocephalus*, Bl. 286;—*L. malapterus*, Bl. 285;—*L. chloropterus*, Bl. 288;—*L. bivittatus*, 284, 1;—*Julis crotaphus*, Cuv., Parra, XXXVII, 1;—*L. alborivittatus*, Kæhler. Nov. Com. Pet. IX, 458, and Encycl. 399;—*L. mola*, Cuv., Russ. II, 120;—*L. margaritifera*, Cuv., or *Gir. Labiche*, Voy. Freycin. Zool. pl., f. 3;—*L. ornatus*, Carnich. Lin. Trans. XII, xxvii.

‡ The *Girelle Gaymard*, Voy. Freycin. pl. liv, which is also the *Sparus cretus*, Forst. and Renard, part I, pl. ii, No. 11; and part II, 160. N.B. The *Coris* of M.

Others again, have a crescent-shaped or bifurcated tail*.

ANAMPSES, Cuv.,

Have all the characters of a *Girelle*, with the exception of two flat teeth in the jaws, which project from the mouth, and curve outwards.

But one or two species are known; from the Indian Ocean†.

CRENILABRUS, Cuv.,

Which we separate from the *Lutjanus* of Bloch, in order to arrange them in their proper place, have all the characters, external and internal, of a true *Labrus*, and only differ in the dentation of the border of their preoperculum.

Some of them are taken in the northern seas; such as the *Lutjanus rupestris*, Bl. 250; fawn-coloured, with clouded, blackish vertical bands. *Lutjanus norvegicus*, Id. 256; brownish, irregularly spotted and marbled with deep brown. *Labrus melops*; orange, spotted with blue; a black spot behind the eye; pl. xxi, f. 1. *Labrus exoletus*, or *L. palloni*, Risso; remarkable for the five spines of its anal‡.

The Mediterranean produces a great number which are decorated with the most beautiful colours; the most splendid is the *Labrus lapina*, Forsk.; silvery, with three broad longitudinal bands formed of vermilion dots, yellow pectorals, the ventrals blue, &c.§ They

de Lacépède, established by that naturalist from the drawings of Commerson, have turned out to be fishes of the present genus with truncated tails, the artist having neglected to express the separation of the operculum from the preoperculum. The *Coris angulé*, III, iv, 2, appears to be the *Labrus malapterus*; and the *Coris aigrette*, III, iv, 1, must be closely allied to the *Girelle Gaymard*. M. de Lacépède has also named *Hologymnoses* some of these fishes, in which the scales of the body, smaller than usual, are concealed during life by a thick epidermis; but the scales which do not appear in the drawing of Commerson, engraved Lacép. III, pl. 1, f. 3, are very visible in the dried specimen deposited in the Museum; that genus must therefore be included in *Julis*, together with the *Demi-Disque*, III, pl. vi, f. 1; the *Annelé*, Ib. pl. xxviii, and the *Cerclé*, which at least are closely allied to it.

* Species with crescent-shaped or forked tails; *Labre hébraïque*, Lacép. III, xxix, 3;—*Labrus bifasciatus*, Bl. 283;—*L. lunaris*, L., Gron. Mus. II, vi, 2, cop. Encycl. 196;—*L. lunaris*, Bl. 281, which is different, and may possibly be nothing more than an altered *Julis turcica*;—*L. viridis*, Bl. 282;—*L. brasiliensis*, Bl. 280;—*Julis cœruleocephalus*, Cuv., or *Girelle Duperrey*, Voy. Freycin. Zool. pl. f. 333;—*L. argenté*, Lac. III, xviii. N.B. The *Scarus gallus*, Forsk., is probably the same as the *Lab. lunaris*.

† *Labrus tetrodon*, Bl. Schn. 263;—*Anampses Cuvieri*, Quoy and Gaym. Voy. Freycin. Zool. pl. lv, f. 1.

‡ Add, *Lab. gibbus*, Penn. xlv. copied Encycl. 403;—*Lutj. virescens*, Bl. 254, 1.

§ Risso describes several in his first edition under the name of *Lutjanus*; in the second he adopts our genus *CRENILABRUS*, and carries the number of species to twenty-eight; but all his species are not distinct, and his synonymes are sometimes uncertain. His species should be compared with those of Brunnich, Bloch, &c. The *Lab. venosus*, Brunn.;—*L. fuscus*, Brunn.;—*L. unimaculatus*, Brunn.;—*Lutjanus rostratus*, Bl. 254, 2, perhaps the *Cr. tinca*, Risso;—*Lab. 5-maculatus*, Bl. 291, 2, is the *Crenil. Roissal*, Risso;—*Lutj. bidens*, Bl. 251, 1;—*Lab. mediterraneus*, Brunn.;—*Lab. rubens*, Brunn.;—*Lab. perca*, Brunn.;—*Lab. spalatensis*, Br.;—*Lab. tinca*, Brunn.;—*Lab. ocellatus*, Forsk., or *olivaceus*, Brunn., &c.

abound also in the seas of hot climates*, and several species hitherto left among the Labri should be placed here.

CORICUS, Cuv.

The Sublets have, with all the characters of a Crenilabrus, the mouth nearly as protractile as that of an Epibulus.

The species known are small, and from the Mediterranean†.

We must remove the following fishes from the genus Sparus, in order to place them near Coricus or Cheilinus:—

EPIBULUS, Cuv.

The Filous are remarkable for the excessive protractility of their mouth, which, by a see-saw motion of their maxillaries, and the sliding forwards of their intermaxillaries, instantly becomes a kind of tube. They employ this artifice to capture the small fry which pass within reach of this singular instrument; it is also resorted to by the Corici, Zei and Smares, according to the greater or less protractility of their jaws.

The entire body and head of an Epibulus is covered with large scales, the last range of which even encroaches upon the anal and caudal fins, as is the case in Cheilinus; the lateral line is similarly interrupted, and, as in the latter and in Labrus, there are two long conical teeth in front of each jaw, followed by smaller blunt ones; we have not had an opportunity of observing those in the pharynx.

But a single species is known; *Sparus insidiator*, Pal. Spic. Zool. Fasc. VIII, pl. v, 1, of a reddish colour. From the Indian Ocean.

CLEPTICUS, Cuv.

Have a small cylindrical snout, which is suddenly protruded like that of an Epibulus, but which is not as long as the head; the small teeth barely perceptible to the touch; the body is oblong, head obtuse, and the lateral line continuous; the dorsal and anal enveloped by scales nearly to the summit of the spines.

C. genizara, Cuv.; Parra, pl. xxi, f. 1. The only species known; of a purple red. From the Antilles.

GOMPHOSUS, Lacép.—ELOPS, Commers.

The Gomphoses are Labroides, with an entirely smooth head, as in Julis; but, owing to the prolongation of the intermaxillaries and maxillaries, which are united by the teguments as far as the small opening of the mouth, the muzzle is made to resemble a long thin tube‡.

* At the head of the list should be the *Lutjanus verres*, Bl. 255, the same as his *Bodianus bodianus*, 223, and as the *Perro colorado*, Parra, pl. III, f. 1.—Add, *Lutjanus notatus*, Bl. 251, 2;—*L. violaceus*, or *L. Linkii*, Bl. 252;—*L. virescens*, Bl. 254, 1;—*Lab. burgall*, Schæpp., or *L. chogset*, Mitch. III, 2?—*L. chrysops*, Bl. 248.

† The *Lutjanus viridens*, and the *L. Lamarkii*, Riss., first edition. In the second he adopts this subgenus, and adds to it a *Coricus rubescens*.

‡ *Gomphosus viridis*, Cuv., or *G. Lacépède*, Quoy and Gaym. Voy. Freycin. Zool.

They are taken in the Indian Ocean, and the flesh of certain species is held in the highest estimation*.

XIRICHTHYS, *Cuv.*,

Are fishes resembling a Labrus as to form, but are much compressed; the front descends suddenly towards the mouth in a trenchant and almost vertical line, formed by the æthmoid and the ascending branches of the intermaxillaries. Their body is covered with large scales; the lateral line is interrupted; the jaws are armed with a range of conical teeth, the central ones longest; the pharynx is paved with hemispherical teeth; the intestinal canal is continuous with two flexures without cæca; no cul-de-sac to the stomach; a tolerably long natatory bladder. Until we arranged them otherwise, they were always placed by naturalists among the Coryphænæ, from which they greatly differ, both internally and externally. They approximate most to Labrus, only differing in the profile of the head†. The greater number have a naked head. Such is

X. novacula; *Coryphæna novacula*, L.; Rondel. 146; Salv. 117. (The Razor Fish of the Mediterranean). Red, variously striped with blue. The flesh is esteemed‡.

Some of them have a scaly cheek§, and others are distinguished by small scales||.

CHROMIS¶, *Cuv.*,

Have the lips, protractile intermaxillaries, pharyngeal bones, dorsal filaments, and port, of a Labrus; but the teeth of the pharynx and jaws resemble those of a card, and there is a range of conical ones in front. The vertical fins are filamentous, those of the belly being even frequently extended into long threads; the lateral line is interrupted; the stomach forms a cul-de-sac, but has no cæca.

C. vulgaris; *Sparus chromis*, L.; *Petit Castagneau*, Rondel. 152. (The Common or Black Coracinus of the antients). A small chestnut-brown fish, taken by thousands in the Mediterranean.

C. niloticus; *Lab. niloticus*, the *Boliti*, Hasselq. 346; Sonnini,

pl. lv, f. 2;—*G. cæruleus*, Lacép. III, pl. v, f. 1, or *Acarauna longirostris*, Sevastianof, Nov. Act. Petrop. xiii, t. XI;—*G. variegatus*, Lacép. Ib. f. 2.

Gomphosus, from the Greek *gomphos*, a wedge.

* Renard, Poissons de la mer des Indes, part II, pl. xii, f. 109. Commerson, however, says that the *cæruleus* is but indifferent food.

† The sharp edge of the head of the Coryphænæ is owing to the interparietal crest; their scales are small and soft; their cæca numerous. See Mém. du Mus. II, 324.

‡ The *Coryph. lineolata*, Rafn., Caratt. 33, does not differ from the *novacula*; but the *Novacula coryphæna*, of Risso, is nothing more than the *Centrolophus*. The *Coryph. cærulea*, Bl. 176, is a *Scarus*.—Add, *Cor. psittacus*, L., and some new species.

§ *Coryphæna pentadactyla*, Bl. 173, or *Blennius maculis*, 5, &c. Ankarstrom, Stockh. Mem. pl. iii, f. 2. Linnæus has confounded it with the five-toed fish of Nieuhof, Willoughb. App. pl. viii, f. 2, which is a mere Pilot-fish, thereby inducing M. de Lacépède to make his genus *Hemipteronotus* of it, whose characters by no means correspond to this *Xirichthys*.

|| *Rason l'écluse*, Quoy and Gaym. Voy. Freycin. Zool. pl. lxxv, f. 1.

¶ *Chromis*, *Chremis*, *Chreme*, Greek names of an unascertained fish.

pl. xxvii, f. 1*. (The White or Egyptian Coracinus of the antients). Found in the Nile; it is two feet long, and is considered the best fish of Egypt.

CYCHLA, Bl. Schn.

They differ from the preceding genus by their teeth being small and crowded, forming a broad band, as well as by the greater elongation of the body†.

PLESIOPS, Cuv.,

Are Chromis with a compressed head, approximated eyes, and extremely long ventrals.

MALACANTHUS, Cuv.

The Malacanthus have the general characters of a Labrus, and similar maxillary teeth, but the pharyngeal teeth are like those of a card, as in Chromis, &c.; the body is elongated, the lateral line continuous, and the operculum terminated by a small spine; the long dorsal has but a small number of spines; the anterior ones thin and flexible.

A species is found in the French Antilles, called by the inhabitants *Vive*; it is the *Coryphæne Plumier*, Lacép. IV, viii, 1; yellowish, irregularly and transversely streaked with violet‡; a crescent-shaped tail.

SCARUS, Lin.

The Parrot Fishes are remarkable for their jaws, (that is, their intermaxillary and pre-mandibular bones), being convex, rounded, and furnished with teeth, which are arranged like scales upon their edge, and upon their anterior surface; these teeth succeed each other from behind

* Add, *Labrus punctatus*, Bl. 295, 1;—*Labre filamenteux*, Lac. III, xviii, 2;—*Lab. 15-épines*, Id. Ib. XXV, 1;—*Sparus surinamensis*, Bl. 277, 2;—*Chaetodon suratensis*, Bl. 217?—*Perca bimaculata*, Bl. 310, 1.

† I strike out many species from the genus CYCHLA as constituted by Bloch, but I leave there, *C. saxatilis*, Bl. 309;—*C. ocellaris*, Bl. Schn. pl. lxi;—*C. argus*, Valenc. App. Humb. Obs. Zool. tom. II, p. 109;—perhaps the *C. brasiliensis*, Bl. 310, 2, and new species. But the *C. erythrura*, Bl. 261, and the *C. argyrea*, are GERRES; the *C. cuning*, a CÆSIO; the *C. brama*, a CANTHARUS; the *C. macrophthalmus*, Bl. 268, the *C. japonica*, Id. 277, 1, the *C. cynodon*, Id. 278, 1, belong to DENTEX; the *C. surinamensis*, Id. 277, 2, and the *C. bimaculata*, Id. 310, 1, to CHROMIS; the *C. guttata*, Bl. 312, the *C. maculata*, Id. 313, the *C. punctata*, Id. 314, to SERRANUS, or, according to the system of Bloch, to BODIANUS. The *C. pelagica* is the CARANXOMORE of Lacép., or the *Coryphæna pelagica*, L. It is easily seen that Bloch was quite as unfortunate in the construction of his genus CYCHLA, as in that of GRAMMISTES.

The *Hiatulæ* would be Labri without an anal fin; but a single species, however, is quoted (from Carolina), and that merely from a note by Garden, which requires confirmation (*Labrus hiatula*, L.). It is not easy to imagine why Bloch, Schn. p. 481, placed it in *Trachypterus*.

‡ N. B. This fig., taken from Plumier, was altered by Bloch to represent his *Coryphæna Plumieri*, pl. 175. Lacépède gives a more exact one. It is also the *Matejuelo blanco* of Parra, XIII, 1, or the *Sparus oblongus*, Bl. Schn. 283.

Add, the *Tableu* of the Isle of France, or *Labre large raie*, Lacép. III, xxviii, 2, the description of which is found, tome IV, p. 204, under the name of *Tænianote large raie*.

forwards, so that those of the base are the newest, and in process of time form a row on the edge. Naturalists have erroneously thought that the bone itself was naked. These jaws, during the life of the fish, are covered besides by fleshy lips, but there is no double one adhering to the sub-orbital. They have the oblong form of a Labrus, large scales, and an interrupted lateral line; they have three pharyngeal plates, two above and one below, furnished with teeth as in a Labrus; but these teeth are transverse blades, and not like rounded paving-stones.

A species which assumes a blue or red colour, according to the season, is found in the Archipelago, which is the *Scarus creticus*, Aldrov. Pisc. p. 8; and which late researches have convinced me is the *Scarus*, so highly celebrated among the antients: the same that Elipertius Optatus, commander of a Roman fleet, during the reign of Claudius, went to Greece in search of, for the purpose of distributing it through the sea of Italy. It is an article of food in Greece at the present day*.

Numerous species are found in the seas of hot climates. The form of their jaws and the splendour of their colours have caused them to receive the vulgar appellation of *Parrot-fishes*.

Some of them have a crescent-shaped tail†, and of these a few with a singularly gibbous forehead‡.

In others it is truncated§. We separate from *Scarus* the

CALLIODON, Cuv.,

In which the lateral teeth of the upper jaw are separate and pointed, and in which there is an inner range of much smaller ones on the same||; and the

ODAX, Cuv.,

Which approach a true Labrus in the inflated lips and in the continuous lateral line; the jaws, composed like those of a *Scarus*, are however flat and not gibbous, and are covered by the lips; the pharyngeal teeth are arranged as if paved, as in Labrus¶.

* N. B. It is not the *Sc. creticus* of Bloch, 228.

† *Scarus coccineus*, Bl., Schn., Parra, XXVIII, 2, which is the *Sparus abildgardii*, Bl. 259, and the *Spare rougeor*, Lacép. III, xxxiii, 3;—the *Great Scarus with blue jaws*, *Sc. guacamaia*, Cuv., Parra, XXVI;—the *Sc. Catesby*, Lacép., Catesb. II, xxix;—the *Sc. bridé*, Lacép., IV, 1, 2;—*Sc. chrysopterus*, Bl., Schn. 57;—*Sc. capitaneus*, Cuv., which is the *Sc. ennéacanthé*, Lacép. IV, p. 6, and his *Sc. denticulé*, Id., p. 12 and pl. 1, f. 1, and of which he gives a description annexed to the *Sc. chadri*.

‡ *Sc. loro*, Bl., Schn., Parra, XXVII, 1;—*Sc. cœruleus*, Bl., Schn., Parra, XXVII, 2, and Catesb. II, xiii, which is also the *Coryphæna cœrulea*, Bl. 176, and what is more extraordinary, the *Spare holocyanose*, Lacép. III, xxxiii, 2, and IV, p. 441, derives its origin from the same drawing of Plumier as this figure of Bloch.

§ *Sc. retula*, Bl., Schn., Parra, XXVIII, 1;—*Sc. tæniopterus*, Desmarest;—*Sc. chloris*, Parr. XXVIII, 3;—*Sc. psittacus*, Forsk.;—*Sc. viridis*, Bl.

|| *Scarus spinidens*, Quoy and Gaym., Zool. Voy. Freycin., p. 289, and some new species.

¶ *Scarus pullus*, Forster, Bl., Schn. 288.

The fifteenth and last family of the Acanthopterygians, or that of

FAMILY XV.

FLUTE-MOUTHS,

Sometimes called Tobacco-pipe Fish, have for their distinguishing character a long tube in front of the cranium, which is only a continuation of the æthmoid bone, the vomer, the preopercula, the interopercula, the pterygoid, and tympanal bones: at the extremity of this tube is observed the mouth, which is formed in the usual way by the intermaxillary, maxillary, palatine, and mandibular bones. Their intestine is not marked by any considerable inequalities, or by numerous folds, and the ribs are short or altogether absent. One portion of the Flute-Mouths (the *Fistularia*) have the body cylindrical; the other (the *Centriscus*) have it oval and compressed.

FISTULARIA, *Lin.*

The Tubular Fishes take their name in particular from the long tube which is common to the whole family. The jaws are at its extremity, slightly cleft in a nearly horizontal direction. This head, thus elongated, constitutes the third or fourth of the total length of the body, which is itself long and thin. There are six or seven rays in the branchiæ, and some bony appendages extend behind the head, upon the anterior part of the body, which they strengthen more or less. The dorsal is opposite to the anal; the stomach, resembling a fleshy tube, is continued in a straight canal, without duplicatures, to the commencement of which are attached two cæca. In

FISTULARIA, *Lacép.,*

The *Fistularia*, properly so called, there is but a single dorsal, composed for the most part, as well as the anal, of simple rays. The intermaxillaries and the lower jaw are armed with small teeth. From between the two lobes of the caudal proceeds a filament which is sometimes as long as the body. The tube of the snout is very long and depressed, the natatory bladder excessively small, and the scales invisible. They are found in the seas of hot climates in both hemispheres*. In the

AULOSTOMUS†, *Lacép.,*

The dorsal is preceded by several free spines, and the jaws are without teeth; the body, very scaly and less slender, is widened and compressed between the dorsal and the anal, and following it is a short and very small tail, terminated by a common fin. The tube of the snout is shorter, thicker, and compressed; natatory bladder very large.

* *Fistularia tabacaria*, Bl. 387, 1; *Fist. serrata*, 1d., 1b. 2; are from America, Marcgr. 148, Catesb. II, xvii;—*Fist. immaculata*, Commers., J. White, p. 296, f. 2, is from the Indian Ocean.

† *Aulostomus*, from the Greek *aulos*, a flute, and *stoma*, a mouth.

But a single species is known; from the Indian Ocean*.

CENTRISCUS†, *Lin.*,

Vulgarly called the Bécasses de Mer, or Sea-Snipes, have, in addition to the tubular snout of this family, an oval or oblong, but unelongated body, compressed on the side, and trenchant beneath; branchiæ composed of but two or three slender rays; a first spinal dorsal and small ventrals behind the pectorals. The mouth is very small, and cleft obliquely; the intestine is without cæca, and is doubled three or four times, and the natatory bladder is considerable. In

CENTRISCUS, *properly so called,*

The first spine of the anterior dorsal, which is placed very far back, is long and stout, and supported by an apparatus connected with the head and shoulder. They are covered with small scales, and have, besides, some broad and dentated plates on the apparatus just mentioned.

C. scolopax, L., Bl. 123 ‡. (The Sea-Snipe). A very common species in the Mediterranean, but a few inches long, and of a silvery colour. In the

AMPHISILE, *Klein.*,

The Amphisiles, the back is mailed with broad scaly pieces, of which the anterior spine of the first dorsal seems to be a continuation.

Some of them even have other scaly pieces on the flanks, and the spine in question placed so far behind that it thrusts the second dorsal and anal towards the lower part of the tail. Such is the *Centriscus scutatus*, L., Bl. 123, 2, The Shielded Sea-Snipe.

Others are intermediate between this disposition and that of a common Centriscus. Their cuirass covers but the half of the back,—*Centriscus velitaris*, Pall., Spic. VIII, iv, 8. Both these species are from the Indian Ocean.

The second division of ordinary Fishes, or that of the Malacopterygians, contains three orders, characterized by the position of the ventrals, or by their absence. The second order of Fishes is that of

ORDER II.

ABDOMINAL MALACOPTERYGIANS,

THAT is to say, Fishes in which the ventrals are suspended to the under part of the abdomen and behind the pectorals, without being attached to the bones of the shoulder. It is the most numerous of the three, and comprehends most of the fresh-water fishes. We subdivide it into five families.

* *Fistularia chinensis*, Bl. 388.

† *Centriscus*, from the Greek *kentao*, to sting.

‡ It is also the *Silurus cornutus*, Forsk., the *Macroramphosc*, Lac.

FAMILY I.



CYPRINIDÆ.

The first family, the Cyprinidæ, is recognized by the slightly-cleft mouth, the weak jaws, generally without teeth, and whose border is formed by the intermaxillaries; by the pharyngeals, which are supplied with strong teeth, and which compensate for the trifling armature of the jaws, and by the small number of the branchial rays. Their body is scaly, and they have no adipose dorsal, such as we shall find in the Siluri and in the Salmons. Their stomach has no cul-de-sac, neither are there any cæcal appendages to their pylorus. Of all fishes they are the least carnivorous.

CYPRINUS, *Lin.*

These form a very numerous and natural genus, easily distinguished by their small mouth, their jaws without any teeth, and the three flat rays of the branchiæ. Their tongue is smooth; the palate provided with a thick, soft, and singularly irritable substance, commonly termed a "carp's tongue." The pharynx presents a powerful instrument of mastication, consisting of stout teeth attached to the inferior pharyngeal bones, which are so arranged as to be able to squeeze alimentary matters between them, and of a stony disk set in a wide cavity under a process of the sphenoid. These fishes have but one dorsal, and their body is covered with scales, which most commonly are very large; they live in fresh water, and are perhaps the least carnivorous of the whole class, feeding chiefly on seeds, grass, and even mud. The stomach is continuous with a short intestine, which has no cæcum, and their natatory bladder is divided into two by a strangulation.

We divide them into subgenera as follows:—

CYPRINUS, *Cuv.*

Carps, properly so called, have a long dorsal, in which, as well as in the anal, the second ray is formed by a spine more or less stout.

Some of them have cirri at the angles of the upper jaw. Such is

Cyp. carpio, L., Bl. 16. (The Common Carp). Olive-green; yellowish beneath; dorsal and anal spines strong and dentated; cirri short; pharyngeal teeth flat, with a striated crown. Originally from central Europe, it now inhabits the ponds of France, where it attains a length of four feet. It is easily bred in fish-ponds, and is generally esteemed*.

* The Cyprini *Anne-Caroline*, Lacép. V, xviii, 1, *rouge-brun*, Id., Ib. XVI, 1, *mordoré*, Ib. 2, *vert-violet*, Ib. 3, known merely from Chinese paintings, closely approach the Carp. The Chinese, who take much delight in breeding these fishes, obtain many varieties, all very different, the figures of which are seen in their drawings: it would not be safe, however, to consider them as species upon these documents only.

Monstrous individuals of this species are sometimes taken with a very gibbous front and short snout.

A race with large scales is bred, in certain individuals of which the skin is naked in spots, or even entirely: it is called the *Reine des Carpes*, *Carpe à miroir*, *Carpe à cuir*, &c.,—*Cyprinus rex cyprinorum*, Bl. 17.

In others the cirri are deficient. Such, in Europe, are

Cyp. carassius, L., Bl. XI. (The Carreau or Carassin). The body elevated; lateral line straight; head small; caudal truncated. Common in the north of Europe.

Cyp. gibelio, Gm., Bl. 12. (The Gibeles). The body somewhat less elevated; lateral line arcuated below; caudal crescent-shaped. Common in the environs of Paris. The spines of these two species are weak, and it is with difficulty that any dentations are to be perceived in them.

Such also is the species which is so highly valued in France, where it has been excessively multiplied, on account of the splendour and variety of its colours.

Cyp. auratus, L., Bl. 93. (The Golden Carp, or the Dorade of China). Dorsal and anal spines dentated as in the common Carp. This fish is at first blackish, and by degrees assumes that splendid golden red which characterizes it; some, however, are of a silver colour, and others again are marked by various shades of these three colours. Individuals are found without a dorsal, others have a very small one; the caudal of a third is very large, and is divided into three or four lobes: the eyes of a fourth are excessively distended; all these accidental changes, which are the result of domestication, may be variously combined*.

To this group also belongs the smallest of the European Carps,

Cyp. amarus, Bl. VIII, 3; *La Bouvière*, or *Péteuse*. An inch long; greenish above; of a fine pale yellow beneath; in the spawning season, in April, it has a steel blue line on each side of the tail; the second dorsal ray forms a tolerably rigid spine.

BARBUS, Cuv.

The Barbels have the dorsal and anal short; the second or third ray of the dorsal formed by a stout spine; four cirri, two on the end of the upper jaw and two at its angles.

B. vulgaris; *Cyprinus barbus*, L., Bl. 18. (The common Barbel). Known by its oblong head; common in clear streams and fish-ponds, where it is sometimes found ten feet in length. Italy has some neighbouring species, whose spine is weaker, and which

* Such are the *Cyp. macrophthalmus*, Bl. 410, or the *gros yeux*, Lacép. V, xviii, 2, the *C. quatre lobes*, Lacép., Ib. 3, and the varieties of the Gold-fish, Bl. 93, 94, &c. See *Collection des Dorades de la Chine*, Sauvigny et Martinet. Add, *Cyp. devarid.*, Buch., pl. vi, f. 94;—*C. catla*, Id., pl. xiii, f. 81.

still are distinguished from the Gudgeons by their four cirri—*B. caninus*, Bonnelli; *B. plebeius*, Val.; *B. eques*, Id.*

GOBIO, Cuv.

The Gudgeons have both the dorsal and the anal short; both are without spines or cirri.

We have a species dotted with brown, which, notwithstanding its smallness, is highly esteemed. They live in shoals in the rivers of France; they seldom exceed each eight inches in length †.

TINCA, Cuv.

The Tenches combine, with all the characters of the Gudgeons, the peculiarity of having very small scales; their cirri also are very small.

There is one of these fishes, *Cyp. tinca*, L., Bl. 14, (The Tench), short and thick, of a yellowish-brown, found in France, which is only eatable when taken in certain streams, and is sometimes of a fine golden colour—*Cypr. tinca auratus*, Bl. 25. It prefers stagnant waters.

CIRRHINUS, Cuv.

The Cirrhines have the dorsal larger than that of a Gudgeon; the cirri on the middle of the upper lip ‡.

ABRAMIS, Cuv.

The Breams have neither spines nor cirri; their dorsal is short and placed behind the ventrals; a long anal. Two species are found in France.

A. vulgaris; *C. brama*, L., Bl. 13. (The common Bream). The largest species of this subdivision: there are twenty-nine rays in the anal, and all the fins are obscure. It is a good fish, and is very abundant.

C. blica; *C. latus*, Gm., Bl. 10; The Little Bream; *La Borde-lière*, or *Hazelin*; have reddish pectorals and ventrals; twenty-four

* Add the Barbels of the Caspian Sea: *Cyp. mursa*, Guldenstedt, Nov. Comm. Petrop. XVII, pl. xviii, f. 3, 5;—*C. bulatmai*, Pall., and the Barbel of the Nile; *Cyp. binny*, Forsk. 71; Sonnini, pl. xxvii, f. 3, or *Cyp. lepidotus*, Geoff. Eg. Poiss. du Nil., pl. x, f. 2.

N. B. Bruce, after giving the history of the true Binny, applies to it, through a mistake, the figure and description of a *Polynemus*, which he must have taken in the Red Sea: hence the ideal species, *Polynemus niloticus*, Shaw.

Barbels are also found in India: such are *Cypr. calbasu*, Buch., Fishes of the Ganges, pl. 11, f. 33;—*C. coesa*, Id., pl. iii, f. 77;—*C. Daniconius*, Id. XV, 89;—*C. kunama*, Russ. 204;—*C. morula*, Buch. XVIII, 91;—*C. gonijs*, Ib. IV, 82;—*C. Rohita*, Ib. XXXVI, 85, and several others to be described in our Ichthyology; they are also found in America.

† Add, *Cyp. capoeta*, Guldenst., Nov. Com. Petrop. XVII, pl. xviii, f. 12;—*C. curmuca*, Buch. Trav. to the Mysore, III, pl. xxx;—*C. bendelisis*, Id., Ib., pl. xxxii.

‡ *Cyp. cirrhusus*, Bl. 411;—*C. mrigala*, Buch., pl. vi, f. 79;—*C. nandina*, Id. VIII, 84?

rays in the anal; is not much esteemed, being chiefly used as food for other fishes in ponds*.

LABEO, *Cuv.*

The Labeons have the dorsal long, as in the Carps properly so called, but both the spines and cirri are wanting; remarkably thick, fleshy lips, frequently crenated. They are all foreign to Europe†.

CATASTOMUS, *Lesueur.*

The Catastomes have the same thick, pendent and fringed, or crenated lips, as in Labeo; but the dorsal is short, like that of a Leuciscus, and is opposite to and above the ventrals. From the rivers of North America‡.

LEUCISCUS, *Klein.*

The Ables, commonly called White Fishes, have the dorsal and anal short; neither spines nor cirri; nothing particular about the lips. This subdivision is rich in species, but they are not much esteemed. They are known in different parts of France by the various and rather indistinct appellation of *Meunier*, *Chevanne*, *Gardon*, &c.§

We distinguish them according to the position of their dorsal, a character, however, which is not always sufficiently clear. In some the dorsal is opposite to the ventrals. Of this group we find in France,

L. dobula; *Cyp. dobula*, L., Bl. 5; *Le Meunier*. The head broad, and snout round; pectorals and ventrals red.

L. idus; *C. idus*; *Le Gardon*, Bl. 6, and better, *Meidinger*, 36. About the same colours; the head narrower, back higher, and snout more convex.

L. rutilus; *Cyp. rutilus*, L.; *La Rosse*, Bl. 2. (The Roach). Body compressed, silvery; red fins.

L. vulgaris; *Cyp. leuciscus*; *La Vandoise*, Bl. 97, f. 1. (The Dace). Body straight; fins pale; snout slightly prominent. The

L. nasus; *Cyp. nasus*, L.; *Le Nez*. (The Nase). Is taken in the Rhine; its snout is more salient and obtuse than that of the Leuciscus||.

* Add three fishes which ascend the tributaries of the Baltic: the *C. ballerus*, Bl. 9, the *C. vimba*, L., Bl. 4, and the *C. Buggenhagii*, Bl. 95; and of foreign species, *C. cotis*, Buch., pl. xxxix, f. 93.

† *C. niloticus*, Geoff. Poiss. du Nil, pl. ix, f. 2;—*C. fimbriatus*, Bl. 409, to which must be added the *Catostomus cyprinus*, Lesueur.

‡ M. Lesueur describes seventeen species, Journ. Acad. Nat. Sc. of Philad. 1817, vol. I, p. 88 et seq. and figures nine of them; the first, however, *Cat. cyprinus*, must be abstracted, as it is rather a Labeo. Add, *Cypr. teres*, Mitch. op. cit. I, vi, 11, and the *Cyprin sucet*, Lacép. V, xv, 2.

§ Bloch and his successors have not adhered to the customary application of these French names, which they have distributed almost at random.

|| Add, *C. grislagine*;—*C. jesus*, and of foreign species, *C. pala*, Cuv., Russ. 207;—*C. tolo*, Cuv., Russ. 208;—*C. boga*, Buch. Pisc. Gang., pl. xxviii, f. 80;—*C. mola*, Ib.

In others, the dorsal is placed opposite the interval between the ventrals and the anal. Of this group are found in France,

L. erythrophthalmus; *Le Rotengle*; Bl. 1. (The Rud). Fins red as in the Rutilus; the body thicker and more elevated.

L. alburnus; *Cyp. alburnus*, L.; *L'Ablette*, Bl. 8, f. 4. (The Bleak). Body narrow, silvery, brilliant; fins pale; front straight; the lower jaw somewhat longer; very abundant throughout Europe. It is one of those fishes from which nacre is obtained for the manufacture of false pearls.

L. bipunctatus; *Cyp. bipunctatus*, L.; Bl. 8, f. 1. (*Le Shirlin*, or the Seine Smelts). Very similar to the Bleak; two black points on each scale of the lateral line.

L. phoxinus; *Cyp. phoxinus*, L.; Bl. 8, f. 5; *Le Veron*. (The Minnow). Spotted with blackish; the smallest of the French species.

L. orphus; *C. orphus*; Bl. 95; *L'Orfe*, A fine red-lead red; from the rivers of Germany and Holland*.

There are some again, where it is opposite to the commencement of the anal—the CHELÆ of Buchanan; in several of these the body is compressed almost as in certain Clupæ. Such is

L. cultratus; *Cyp. cultratus*, L.; Bl. 37. (The Razor). Also remarkable for its lower jaw, which ascends in front of the upper one; for its large falciform pectorals, &c.†

Species with cirri are found in this group‡. We may separate from all other Cyprini, the

GONORHYNCHUS, Gronov.,

Gonorhinques, in which the head and body are elongated, as well as the opercula, and even the membrane of the gills, with small scales; the snout projects before a small mouth, which is without teeth and cirri; there are three rays in the branchiæ, and a small dorsal is inserted above the ventrals.

G. vulgaris; *Cyp. gonorhynchus*, Gm., Gronov. Zooph. pl. x, f. 24. The only species known is found at the Cape of Good Hope||.

XIX, f. 86;—*C. sophore*, Ib. XXXVIII, f. 92;—*C. ariza*, Id. Trav. in the Mysore, III, xxxi.

The difficulty of recognizing the figures given by authors of species so similar, is increased from the circumstance, that many species are found in the rivers of Europe which have never been figured.

* Add, the *C. aspius*, Bl., and of species foreign to Europe; *Cyp. basbora*, Buch., Pisc. Gang. II, f. 90;—*C. morar*, Ib. XXXI, f. 75, and a vast number from the rivers of all parts of the globe, several of which have already been indicated by M. Mitchil and Buchanan; some others will be described in our Ichthyology. M. Buchanan alone found eighty Cyprini in India. We have only cited here the two he has figured.

† Add, *Cyp. clupeoides*, Bl. 408, 2;—*C. bacaila*, Buch. VIII, 76.

‡ *Cypr. dantica*, Id. XVI, 88.

|| Badly copied, Schn. 78.

COBITIS*, *Lin.*

The Loaches have the head small; body elongated, invested with small scales and covered with mucus; ventrals very far back, and above them a single small dorsal; the mouth at the extremity of the snout, but slightly cleft, without teeth, but encircled with lips fitted for sucking, and with cirri; but three rays in the branchiæ, the apertures of which are small; the inferior pharyngeal bones strongly dentated, there is no cæcum in their intestine; and their very small natatory bladder is enclosed in a bony bilobate case, which adheres to the third and fourth vertebræ†. Three species inhabit the rivers of France.

C. barbatula, L., Bl. 31, 3. (The Common or Bearded Loach). A small fish four or five inches in length, clouded and dotted with brown on a yellowish ground, with six cirri; common in brooks, and a capital fish for the table.

C. fossilis, L.; MISGURN, Lac.‡; Bl. 31, 1. (The Great Loach). Sometimes a foot long, with longitudinal brown and yellow rays, and ten cirri. It lives in the mud of marshes, even long after they have been dried up or covered with ice. In stormy weather it rises to the surface of the water, which its restlessness keeps constantly agitated; when it is cold it descends more deeply into the mud. It is constantly inhaling atmospheric air, which, according to the interesting observation of M. Ehrman, after having been converted into carbonic acid, is discharged per anum. The flesh is soft and smells of mud§.

C. tænia, L. xii; Bl. 31, 2. (The Spiny Loach). Six cirri; the body compressed, orange-coloured, and marked with a series of black spots; distinguished from the two others by a forked and moveable spine, formed before the eye by the suborbital. It is the smallest of the three, and is found in rivers, among stones, &c.; it is not much esteemed||.

ANABLEPS¶, *Bl.*

The Anableps, for a long time and improperly combined with the Loaches, have very peculiar characters: in the first place, their eyes, which are exceedingly prominent beneath an arch formed on each side by the frontal bone, have the cornea and iris divided into two parts by transverse bands, so that these fishes have two pupils, and each appears to be double, although they have but one crystalline lens, one vitreous humour, and one retina**—an arrangement of which no other example is to be found in the

* *Kobitis*, the Greek name of some small undetermined fish.

† See Schneider, Syn. Pisc. Arted. 5 and 337.

‡ I do not separate the Misgurns from the Cobites; there is no difference whatever in their organization, and the number of jaw teeth is not greater in the former than in the latter; I have vainly sought for those described by Bloch.

§ Add, the three species of Cobitis with unarmed cheeks described by Buchanan, Pisc. Gang. p. 357—359.

|| Add, *Cob. geta*, Buch. XI, 96, and the other seven species with armed cheeks described by that Ichthyologist, op. cit. p. 350—356.

¶ From the Greek *anablepo*, to raise the eyes, a name given by Artedi.

** See Lacép. Mém. de l'Institut, tom. II, p. 372.

whole series of vertebrated animals. In the next place, the organs of generation, and the bladder in the male, have their excretory duct in the anterior edge of the anal fin, which is large, long, and covered with scales; its extremity is perforated, and, no doubt, is subservient to copulation. The female is viviparous, and the young are considerably advanced in growth at the moment of their birth.

The body of these fishes is cylindrical, covered with stout scales, it has five rays in the branchiæ, the head flattened, the snout truncated, and the mouth transversely cleft at its extremity; both jaws are armed with small and crowded teeth; the intermaxillaries have no pedicle, and are suspended under the nasal bones which form the anterior edge of the snout; the greater part of the pectorals is scaly, and there is a small dorsal on the tail, and farther backwards than the anal. The pharyngeal bones are large, and furnished with very small globular teeth; the natatory bladder is very large, and their intestine ample, but without cæca.

But a single species is known; the *Anableps tetropthalmus*, Bl. 361; *Cobitis anableps*, L.; it inhabits the rivers of Guiana.

PÆCILIA, Schn.

Have the two jaws horizontally flattened, protractile, slightly cleft, and furnished with a row of extremely small and very fine teeth; top of the head flat; the opercula large; five rays in the branchiæ; the body but little elongated, the ventrals not far back, and the dorsal above the anal. Small viviparous fishes from the rivers of America*. The

LEBIAS, Cuv.

Resemble the Pœcilia, except that their teeth are dentated.

A species is found in Sardinia, the *Pœcilia calaritana*, Bonelli†, a very small fish marked on the flanks with little black streaks.

FUNDULUS, Lacép.

The Fundules are allied in many particulars to the Pœcilia; but their teeth are small and crowded, and those of the anterior row hooked; tolerably stout conical ones are found in the pharynx; there are but four rays in the branchiæ‡. The

MOLINESIA, Lesueur,

Are distinguished by the position of their anal between the ventrals and

* *Pœcilia Schneideri*, Val., or *P. vivipara*, Schn. 86, 2;—*P. multilineata*, Lesueur, Journ. Ac. Nat. Sc. of Philad. 1821, pl. 1;—*P. unimacula*, Val. App. Humb. Zool. Obs. II, pl. li, f. 2;—*P. surinamensis*, Id. Ib. f. 1.

† Add, *Lebias ellipsoïdea*, Lesueur, op. cit. 1821, pl. ii, f. 1 and 3;—*Leb. rhomboidalis*, Val. App. Humb. Zool. Obs. II, pl. li, 3;—*Leb. fasciata*, Id. Ib. 4.

‡ *Fund. caniculus*, Val., or *Cobitis heteroclita*, Lin., or *Pœcilia canicola*, Schn.; *Mudfish* of Schœpf.;—*Fund. fasciatus*, Val. loc. cit. LIII, 1, or *Pœcilia fasciata*, Schn., or *Esox pisciculus*, Mitch., of which his *Esox zonatus*, or *Hydrargyre swampine*, Lacép. V, 319, is the young, but the fig. V. 3, is another species;—*Fund. brasiliensis*, Val. loc. cit. LII, 2.

beneath the origin of the dorsal, which is very large. The teeth are similar to those of a Fondule, and there are only four or five rays in the branchiæ*.

CYPRINODONS, *Lacép.*,

Have slender, small, and crowded teeth; six rays in the branchiæ; otherwise similar to the three preceding genera.

There are some in the lakes of Austria, particularly in subterraneous streams, *Cypr. umbra*, Cuv.; *Umbra*, Cramer; it is of a reddish brown, with some brown spots†.

The second family of the Abdominal Malacopterygians is that of

FAMILY II.

ESOCES,

Or the Pikes, which are also destitute of the adipose fin. The edge of the upper jaw is formed by the intermaxillary, or at least, when it is not quite so formed, the maxillary is destitute of teeth, and concealed in the thickness of the lips. They are voracious; many of them ascend rivers, and their intestine is short and without cæca; they all have a natatory bladder. With the exception of the Microstomæ, all those that are known have the dorsal opposite to the anal. Linnæus united them in the genus

Esox, *Lin.*,

Pikes, which we divide as follows:

Esox, *Cuv.*

The Pikes, properly so called, have small intermaxillaries furnished with little pointed teeth in the middle of the upper jaw, of which they form the two-thirds, but the jaws which occupy their sides have no teeth. The vomer, palatines, tongue, pharyngeals, and rays of the branchiæ, are bristled with teeth like a card; a series of long pointed teeth on the sides of the lower jaw. The snout is oblong, obtuse, broad, and depressed; but one dorsal opposite the anal; the large and plaited stomach is continuous, with an intestine very thin, without cæca, and twice flexed; a very large natatory bladder.

E. lucius, L., Bl. 32. (The Common Pike). Well known as one of the most voracious and destructive of all fishes, but whose flesh is pleasant and of easy digestion. This species, which inhabits Europe, is found also in the fresh waters of North America,

* *Molinesia latipinna*, Lesueur, Ac. Nat. Sc. Philad. 1821, III, 1.

† Add, *Cyprinodon flavulus*, Val. loc. cit. LIII, 3, which is the *Esox flavulus*, Mitch. pl. iv, 8, or the *Cobitis matalis*, Schn.;—*C. ovinus*, or *Esox ovinus*, Mitch., Ib.;—*C. variegatus*, Lacép. V, xv, 1.

where two other species are also to be met with; the flanks of the one, *Esox reticularis*, Lesueur, Ac. Nat. Sc. Philad., are marked with brownish lines, sometimes resembling net-work; the other, *Esox Estor*, Id. Ib. I, 413, is sprinkled with round blackish spots.

GALAXIAS, Cuv.

The Galaxies have no apparent scales on the body; the mouth is slightly cleft; moderate and pointed teeth in the palatines and two jaws; nearly the whole edge of the upper one being formed by the intermaxillary; a few strong, hooked teeth on the tongue. The sides of the head present some pores, and the dorsal is opposite to the anal as in a true Pike, the intestines of which theirs also resemble*.

ALEPOCEPHALUS, Risso,

Possess the same general form, but the head only is deprived of scales, the body being covered with broad ones; their mouth is small, and the teeth extremely delicate and crowded; very large eyes, and eight branchial rays.

Al. rostratus, Risso, 2nd ed. f. 27, and Mem. Acad. Turin, XXV, pl. x, f. 24. The only species known; it is taken in the depths of the Mediterranean.

MICROSTOMA, Cuv.,

Have a very short snout; the lower jaw projecting beyond the upper one, and furnished, as well as the small intermaxillaries, with very minute teeth; three broad and flat rays in the branchiæ: the eye large, the body elongated, and the lateral line covered with a row of stout scales; a single dorsal a short distance behind the ventrals; intestines like those of a Pike.

But a single species is known, the *Serpe microstome*, Risso, p. 356. It inhabits the Mediterranean.

STOMIAS, Cuv.,

Have the snout extremely short, and the mouth cleft almost to the gills; the opercula reduced to little membranous laminae, and the maxillaries fixed to the check. The intermaxillary, palatine, and mandibular bones armed with a few long and hooked teeth; similar ones on the tongue. The body is elongated; the ventrals quite far back, and the dorsal opposite to the anal on the posterior extremity of the body.

Two species of these singular fishes were discovered by Risso in the Mediterranean: they are black, and ornamented along the belly with several rows of silvery points. One of them, *Esox boa*, Risso, 1st ed. pl. x, f. 34, and 2nd ed. f. 40, has no cirri; the other, *Stomias barbatus*, is furnished with very long and thick ones attached to the symphysis of the lower jaw.

* *Esox truttaceus*, Cuv.;—*Esox alepidotus*, Forst.

CHAULIODUS, Schn.

These fishes, as well as can be ascertained from a figure, Catesb. Supp. pl. ix, and Schn. pl. 85, are nearly allied to Stomias in their head and jaws. Two teeth in each jaw cross the opposite one when the mouth is shut. The dorsal corresponds to the interval between the pectorals and ventrals, which are not placed so far back as those of a Stomias; the first ray of this dorsal is extended into a filament.

C. Sloani, Schn. pl. 85; *Esox stomias*, Sh. V, part I, pl. iii; is the only species known, and has never been taken except at Gibraltar. It is fifteen or eighteen inches in length, and of a deep green colour*.

SALANX†, Cuv.

The species of this genus have a depressed head; opercula folding beneath; four flat rays in the branchiæ; jaws short and pointed, each being provided with a range of hooked teeth, and the upper one almost entirely formed by the intermaxillaries, which are without pedicles; the lower jaw slightly elongated from the symphysis by a little appendage furnished with teeth; the palate and bottom of the mouth entirely smooth, as there is not even a lingual projection‡.

BELONE, Cuv.

The Orphies have the whole edge of the upper jaw, which, as well as the lower one, is extended into a long snout, formed by the intermaxillaries,—both furnished with small teeth, no others in the mouth, and those of the pharynx are as if paved. The body is elongated and covered with scales, which are not very apparent—one longitudinal carinated range near the lower edge excepted. The bones are very remarkable for their colour, which is a beautiful green§. The intestines differ but little from those of a Pike.

B. vulgaris; *Esox belone*, L.; Bl. 33. (The Gar Fish). Two feet long; green above, white beneath; found on the coast of France, where its flesh is much esteemed, notwithstanding the colour of the bones. Neighbouring species inhabit all seas. The bite of one of them, which is said to attain a length of eight feet, is considered dangerous||.

* The *Stomias Schneideri*, Risso, Ed. II, f. 37, appears to me to be of another genus, and even of another order.

† *Salanx*, the Greek name of an unknown fish.

‡ There is but one species, a new one.

§ This colour is inherent in the bone, and does not arise either from cooking or the spinal marrow, as was believed by Bloch, ed. Schn. p. 391.

|| The *Brochet de Bantam*, Ren. part II, fol. 14, No. 65;—the *Belone crocodila*, Lesueur, Ac. Nat. Sc. Philad. I, 129, probably the same as the *Wahla kuddera*, Russ. 175, and as the variety of the *Belone*, Lacép. VII, pl. v, f. 1.

Add, *Belone caudimacula*, Cuv., *kuddera*, A, Russ. 176;—*Belone cancila*, Ham. Buchan. XXVII, 70;—*B. argalus*, Lesueur, loc. cit. p. 125;—*B. truncata*, Id. p. 126;—*B. caribæa*, Id. 127, which is perhaps the *timucu* of Marcgr. 168, and other species to be described in our Ichthyology.

SCOMBRESOX, *Lacép.*—SAIRIS, *Rafin.*,

Have the structure of the snout similar to that of a Belone; very nearly the same port and same scales, with the carinated range along the belly; but the last rays of the dorsal and anal are detached, forming spurious fins as in the Mackerel.

One of them is taken in the Mediterranean, the *Scombrésoc campérien*, Lac. V, vi, 3; *Esox saurus*, Bl. Schn. pl. 78, 2; *Sairis nians*, Rafin., Nouv. Gen. IX, 1*.

HEMI-RAMPHUS, *Cuv.*

The Half-Beaks have the edge of the upper jaw, which, as well as that of the lower one, is furnished with small teeth, formed by the intermaxillaries; but the upper jaw is very short, and the symphysis of the lower one is extended into a long point or half-beak without teeth; as to their port, fins, and viscera, they resemble the Belone; scales large and round; and a carinated range of them along the belly.

Several species are found in the seas of hot climates in both hemispheres; their flesh, although oily, is agreeable to the palate †.

EXOCETUS‡, *Lin.*

The Flying-Fishes are instantly recognized among the Abdominales by the excessive size of their pectorals, which are sufficiently large to support them in the air for a few moments. Their head and body are scaly, and a longitudinal range of carinated scales forms a salient line on the lower part of each flank, as in the Half-Beaks, &c.§ The head is flattened above and on the sides; the dorsal placed above the anal; their eyes are large, the intermaxillaries without pedicles, and constituting by themselves the whole edge of the upper jaw; their two jaws are furnished with small pointed teeth, and their pharyngeals with teeth as if paved.

* Add, *Scomber-esox equirostris*, Lesueur, Ac. Nat. Sc. Philad. I, 132;—*Sc. scutellatus*, Id. Ib.

† Species from India: *Hem. longirostris*, Cuv., or *kuddera*, C, Russ. 178;—*H. brevirostris*, or *kuddera*, B, Russ. 177, Willoughb. App. pl. vii, f. 4;—*H. marginatus*, Cuv., Lacép. V, vii, 2;—*H. Commersonii*, Cuv., Lacép. V, vii, 3, or the *Demi-bec de Baggewaal*, Ren. part II, pl. v, No. 21.

American species, *H. brasiliensis*, Cuv., or *Esox brasiliensis*, Bl. 391;—*H. hepsetus*, or *Esox hepsetus*, Bl. Schn., and others to be described in our Hist. des Poissons. See also the article of M. Lesueur, Acad. Nat. Sc. Philad. I, 134, et seq.

N. B. M. de Lac. unites the *Esox hepsetus*, Lin., to the *Es. marginatus*; but the former is a compound of two fishes—one, the *Piquitinga* of Marcgr. 159, (the *mænidia* of Brown, Jam. XLV, 3), is an Anchovy; the other, *Amæn. Ac. I*, p. 321, appears to me to be indeterminate, but it cannot be a *Hemi-ramphus*.

‡ From the Greek *Exokoitos*, sleeping out, the Greek name of a fish, which, according to the ancients, came on shore to rest. It was most probably either a Goby or a Blenny, as imagined by Rondelet and others. It is difficult to conjecture what could have induced Artedi to associate the fishes here in question with these Blennies. Linnæus separated them, but without altering the name of *exocetus*, which does not belong to them.

§ We must not, like Bloch, confound this carina with the lateral line, which, though frequently but slightly marked, is in its ordinary place.

They have ten branchial rays; their natatory bladder is very large, their intestine straight and without cæca; the superior lobe of the caudal is the shortest. They do not fly far: raising themselves to avoid the voracious fishes, they soon fall down again, their wings merely acting as parachutes; birds pursue them through the air, as fishes do through the water. They are found in all the seas of hot and temperate climates.

E. exiliens, Bl. 397. (The Mediterranean Flying Fish). Common in the Mediterranean, and easily recognized by the length of its ventrals, placed posterior to the middle of the body; the fins of the young are marked with black bands*.

E. volitans, Bl. 398. (The common Flying Fish).. Common in the Atlantic Ocean, and has small ventrals placed anterior to the middle of the body†.

The American seas produce species with cirri, which are sometimes simple‡, sometimes double, and even ramous§.

Next to the family of the Pikes we place a genus of fishes, which, though differing but little from the former, has longer intestines and two cæca. It will most probably give rise to a particular family. It is that of

MORMYRUS ||, *Lin.*

The Mormyri are fishes with a compressed, oblong, scaly body; the tail thin at its base, swelling out near the fin; the head covered by a naked, thick skin, which envelopes the opercula and branchial rays, leaving no opening in the latter but a vertical fissure—a circumstance which has led some naturalists to assert that these fishes have no opercula, although they are as perfect as in any other, and which has caused the number of their branchial rays to be reduced to one, although they have five or six. The opening of the mouth is small, and almost like that of the mammiferous animal termed the Ant-Eater; its angles are formed by the maxillaries. Slender teeth, emarginated at the ends, are planted in the intermaxillaries and lower jaw, and there is a long band of small crowded teeth on the under surface of the vomer, and on the tongue. The stomach is a rounded sac, followed by two cæca, and a long slender intestine almost always

* Such was the little Carolina specimen described by Linnæus, and, as I believe, the *Exocetus fasciatus*, Lesueur, Ac. Nat. Sc. Philad. II, pl. iv, f. 2; the second *Pira-bebe* of Pison, 61, is the *volitans*.

† I see, by the drawings of Commerson, and by that of White, Bot. Bay, App., p. 266, as well as by the fishes lately received from our travellers, that both these forms are found in the Pacific Ocean.

N. B. The *exiliens* and the *mesogaster*, Bl. 399, closely resemble each other, and it is not an easy matter to distinguish them by the descriptions and figures of travellers. The *evolans* of Liu. seems to have been a *volitans* whose scales had fallen.

‡ *Exocetus comatus*, Mitch. op. cit. I, pl. v, f. 1, probably the same as the *Ex. appendiculatus*, W. Wood, Ac. Nat. Sc. Phil. IV, xvii, 2.

§ *Exocetus furcatus*, Mitch. op. cit. I, f. 2, which I suspect is the same as *Ex. Nuttallii*, Lesueur, Ac. Nat. Sc. Phil. II, iv, 1.

|| *Mormyros*, the Greek name of a littoral fish variously coloured, probably the *Sparus mormyrus*, L. It was applied by Linnæus, not very happily, to fresh-water fishes of an uniform hue.

enveloped with fat. The bladder is long, ample, and simple. The Mormyri are ranked among the best fishes of the Nile.

One portion of them has a cylindrical muzzle and a long dorsal*.

A second has a cylindrical muzzle and a short dorsal†.

It is very probable, as observed by M. Geoffroy, that it is in one of these two subdivisions that the *Oxyrynchus*, venerated by the Egyptians, is to be found.

In a third the snout is short and rounded, and the dorsal short‡.

In a fourth the forehead forms a gibbous projection in front of the mouth§.

The third family of the Abdominal Malacopterygians is that of

FAMILY III.

SILURIDÆ,

The Siluroids, which is distinguished from all others of this order by the invariable absence of true scales, having merely a naked skin, or large osseous plates. The intermaxillaries, suspended under the ethmoid, form the edge of the upper jaw, and the maxillaries are reduced to simple vestiges, or are extended into cirri. The intestinal canal is ample, flexed, and without cæca; the bladder large, and adhering to a peculiar bony apparatus; the first ray of the dorsal and pectoral is, almost always, a strong articulated spine, and there is frequently an adipose one behind, as in the Salmon.

SILURUS||, Lin.

A numerous genus, easily recognized by its nudity, by the cleft mouth at the extremity of the snout, and, in the greater number of the subgenera, by the strong spine which forms the first ray of the pectoral. It is so articulated with the bone of the shoulder that the fish can voluntarily either bring it close to the body, or fix it perpendicularly in an immoveable position, constituting then a dangerous weapon, wounds from which are con-

* The *Morm. d'Hasselquist*, Geoff. Poiss. du Nil, pl. vi, f. 2;—*M. caschive*, Hasselq. 398, which appears to me to differ from the preceding in several important characters, judging from the description;—the *M. oxyrinque*, Geoff., pl. vi, f. 1, which is the *Centriscus niloticus*, Schn., pl. 30;—*M. commune*, Forsk. 74, which does not agree with any of the preceding by the description.

† The *Morm. de Denderah* or *anguilloides*, L., Geoff., pl. vii, f. 2, confounded with the *Caschive* of Hasselq. by Linnæus, but which is the *Hersé*, Sonnini, Voy. en Eg., pl. xxii, f. 1.

‡ The *Morm. de Salheyhe*, *M. labiatus*, Geoff., pl. xxii, f. 1;—the *M. de Belbeys*, *M. dorsalis*, Id., pl. viii, f. 1, which is the *Kaschoué*, Sonnerat, pl. xxi, f. 3.

§ The *Morm. bané* or *M. cyprinoides*, L., Geoff., pl. viii, f. 2. N. B. The Nile produces several other unpublished species.

|| *Silurus* and *Glanis*, two antient names, at one time employed as synonymes, and, at another, as the reverse, given to certain fishes of the Nile, Danube, and Orontes, and of some rivers of Asia Minor. It is almost certain that they belong to this genus.

sidered in many places as poisoned; an idea arising from the fact that lock-jaw frequently ensues.

The head is depressed, the intermaxillaries suspended under the ethmoid and non-protractile, the maxillaries very short, but each of them almost always continued into a fleshy cirrus, to which are added others attached to the lower jaw or even to the nostrils. The covering of their branchiæ wants that piece which we call the suboperculum; the two superior lobes of the stout and cordiform natatory bladder adhere to a peculiar bony apparatus, which is connected with the first vertebra. The stomach is a fleshy cul-de-sac, the intestine long, ample, and without cæca*. These fishes abound in the rivers of hot climates. Seeds are found in the stomach of various species. In the true *Silurus*, the

SILURUS, Lacép.,

There is only a small fin with very few rays on the fore part of the back, but the anal is very long, closely approaching that of the tail. In *Silurus*, more especially so called,

SILURUS, Artéd. and Gronov.,

There is no evident spine in the small dorsal; the teeth in both jaws resemble a card, and behind the intermaxillary band of the same is another, on the vomer. Such is the

S. glanis, L.; the *Saluth* of the Swiss; *Wels* or *Scheid* of the Germans, the *Mal* of the Swedes, Bl. 34. The largest fresh-water fish found in Europe, and the only one of this extensive genus that it possesses; it is smooth, black, greenish, spotted with black above, with yellowish white beneath: head large, with six cirri; it sometimes exceeds six feet in length, and weighs three hundred pounds. It inhabits the rivers of Germany and Hungary, the lake of Haarlem, &c., and conceals itself in the mud to watch for prey. The flesh, which is fat, is employed in some places for the same purposes as hog's lard†. The

SCHILBE, Cuv.,

Differ from these true *Siluri* in a vertically compressed body, and in a strong and dentated spine in the dorsal. The small, depressed head, suddenly raised neck, and eyes placed very low, give these fishes a singular appearance.

The species, hitherto known, inhabit the Nile, where their flesh is less disagreeable than that of the other *Siluri*, which are found in the same stream. They have eight cirri‡.

* Hasselquist attributes cæca to the *Schilbé*; I have ascertained, however, that the contrary is the fact.

† Add, *Sil. fossilis*, Bl. 370, 2;—*Sil. bimaculatus*, Id. 364;—*Wallagoo*, Russel, 160;—*Sil. attu*, Schn. 75;—the *Sil. chinois*, Lacép. V, ii, 1;—*Sil. asotus*, L., Pall., Nov. Act. Petrop. I, xi, 2.

N. B. Judging from inspection of the dried specimen, the *Ompok siluroïde*, Lacép. V, i, 2, is a *Silurus* whose folded dorsal escaped the notice of the artist who drew it.

‡ *Sil. mystus*, Hasselq., Geoff., Poiss. d'Ég., pl. ii, f. 3 and 4;—*Silurus auritus*, Geoff., Ib., f. 1 and 2.

Certain American species, with a round, blunt, small head, provided with cirri and almost imperceptible eyes, may constitute a new subgenus*. The

MYSTUS, Artéd.; and Lin. in his first Editions ;

Or that of the *Machoirans* †, comprehends Siluri, which, in addition to their first radiated dorsal, have a second that is adipose; they are chiefly the *Pimelodes* and the *Doras* of Lacépède.

PIMELODUS, Lacép.

The body merely covered with a naked skin; no lateral armatures. This subgenus is still much too numerous, and its species differ so widely in conformation, that we have been compelled to divide and subdivide it. We first distinguish the

BAGRUS, Cuv.,

Which have a band of small crowded teeth in each jaw and behind that of the upper one, a similar band on the vomer; they may be subdivided by the number of cirri and the form of the head.

Among those which have eight cirri, some have an oblong and depressed head ‡; while in others it is broad and short §.

Of such as have six cirri, the most remarkable are those with a snout as depressed and broad as that of a Pike, and more so ||.

Some have an oval head, whose shagreen-like bones furnish it with a kind of helmet ¶.

The head of others is round, without the helmet, and merely covered with a naked skin **.

Some are remarkable for a depressed head, eyes placed very low on its sides, and for an extremely small adipose fin; these greatly resemble a Schilbé ††.

Finally, there are others again which have but four cirri †††.

PIMELODUS, properly so called,

Have nothing of the band of teeth in the vomer parallel to that in the upper jaw; but teeth are frequently observed in the palate. The true *Pimelodes*, as to the number of filaments and form of the head, present a greater variety than the *Bagri*.

* *Sil. candira*, Spix, X, 1;—*Sil. cæcutiens*, Id., Ib. 2.

† *Machoiran*, a name given to these fishes in the French colonies. Schneider, p. 478, improperly applies it to *Balistes*.

‡ *Sil. Bayad*, Forsk., *Porcus Bayad*, Geoff., Eg., Poiss., pl. xv, f. 1 and 2;—*Sil. Docmac*, Forsk., Geoff., Ib. 3, 4;—*Pimelodus aor*, Buchan. XX, 68?

§ *Sil. erythropterus*, Bl. 369, 2;—*Pimel. carasius*, Buchan. XI, 67;—*Pim. gullo*, Id. XXIII, 66;—*Pim. carcio*, Id. I, 72;—*Pim. nangra*, Id. XI, 63.

|| *Sil. lima*, Bl. Schn.;—*Sil. fasciatus*, Bl. 366, and various new species. This division forms the genus *SORUBIM* of Spix.

¶ *Pimélode abouréal*, Geoff., Eg., Poiss., pl. xiv, f. 3 and 4;—*Pimel. bilineatus*, Daddi-Jallah, Russel, 169.

** The species are new.

†† They constitute the genus *HYPOPHthalmus* of Spix, of which he has two species, the *Hyp. edentatus*, IX, and the *Hyp. nuchalis*, XVII.

††† *Sil. bagre*, Bl. 365;—*Sil. marinus*, Mitch.

Thus, among those which have but a single band of teeth, some have the head with the helmet, and an osseous plate or distinct buckler between the helmet and spine of the dorsal*.

In others the buckler is united and forms a single piece with the helmet, which thus extends from the snout to the dorsal†.

In others, again, the head is oval, and covered with skin only, through which the bones are not perceptible; of this group some have six cirri‡, and others eight§.

Some, known under the name of *Cats*, have a naked but very broad head; one part of these have six cirri||, and another eight¶.

We should also distinguish those with a small flat head, very small dorsals, and almost imperceptible teeth**.

Then come those *Pimelodes*, which, besides the band of teeth in the jaw, have plates of them in the palatines; these latter teeth may be either small and crowded, or bent like those of a card, and then the plate on the nape may be either distinct from the helmet††, or be united with it‡‡. These palatine teeth are sometimes round, or like small paving-stones§§.

There are some very singular *Pimelodes* with teeth, like those of a card, forming a moveable group under the skin of the cheek|||.

Others have an elongated snout¶¶, or one that is even pointed and nearly edentated***. These latter lead to that much more extraordinary group, the

SYNODONTIS†††, *Cuv.*

Shals, in which the snout is narrow, and the lower jaw supports a bundle of teeth, much flattened laterally, terminating in hooks, and individually suspended by a flexible pedicle—a mode of dentation of which there is no other example known. The rough helmet formed by the cranium is uninterruptedly continuous with an osseous plate which extends to the base of the spine of the first dorsal—a spine which is very strong, as are those of the pectorals. The inferior cirri, and sometimes even the maxillaries, have lateral barbs. These fishes are found in the Nile, and in the Senegal: they are not eaten†††.

* *Sil. clarias*, Bl. XXXV, i, 2;—*Pimel. maculatus*, Lacép. V, p. 103;—*Sil. hemioliopaterus*, Bl., Schn.

† New species.

‡ *Sil. 4-maculatus*, Bl. 368, 2;—*Pim. namdia*, Cuv., Marcgr. 149;—*Pim. Sebæ*, Cuv., Seb III, xxix, 5;—*Pim. pirinamp*, Spix, 8.

§ *Pim. octo-cirrhus*, Cuv., Seb. III, xxix, 1.

|| New species.

¶¶ *Sil. catus*, Lin., Catesb. II, xxiii.

** New species.

†† *Pim. herzbergii*, Bl. 367?—the *Pim. doigt-de-nègre*, Lacép.

‡‡ New species.

§§ New species.

||| *Pim. gemidens*, Cuv., a new species.

¶¶¶ The *Karasche* (*Pim. biscutatus*), Geoff., Eg., Poiss. XIV, i, 2;—*Pim. gagata*, Buchan, XXXIX, 65?

*** *Pim. conirostris*, Cuv.

††† *Synodontis*, the antient name of an undetermined fish of the Nile.

††† *Sil. clarias*, Hasselq., very different from the *clarias* of Gronovius and of Bloch; it is the same as the *Sil. schal*, Schn., Sonnini, Voy. pl. xxi, f. 2, or as the *Pimelode scheilan*, Geoff., Poiss. d'Eg., pl. xiii, f. 3 and 4;—*Pimelodus synodontes*, Geoff., Ib. XII, f. 5;—*Pim. membranaceus*, Id. Ib., f. 1 and 2. N. B. *Schal* is their generic appellation in lower Egypt—*Gurgur* in upper Egypt.

AGENEIOSUS, *Lacép.*,

Have all the characters of a *Pimelodus*, except that there are no true cirri.

In some the maxillary bone is turned up into a kind of dentated horn, instead of being continued into a fleshy and flexible cirrus*.

In others it does not project, and remains concealed under the skin; the dorsal and pectoral spines are but slightly apparent†.

DORAS, *Lacép.*

These are *Machoirans*, that is to say *Siluri*, with a second dorsal, which is adipose, and whose lateral line is mailed with a range of bony plates, each of which is relieved by a spine or salient carina. The dorsal and pectoral spines are very strong and deeply dentated; the helmet is rough, and continues to the dorsal as in *Synodontis*, and their shoulder bone forms a point behind.

Some of them merely have the band of small and crowded teeth in the upper jaw‡.

In others the snout is pointed, and the teeth are either wanting or are hardly visible; the maxillary cirri are sometimes furnished with lateral setæ§.

HETEROBRANCHUS, *Geoff.*

Have the head provided with a helmet that is rough, flat, and broader than that of any other *Silurus*, a circumstance occasioned by two lateral pieces furnished by the frontals and parietals, which cover the orbits and temples. The operculum is still smaller in proportion than in the preceding fishes, and what chiefly distinguishes them from all others is the peculiarity observed by M. Geoffroy, that, besides the ordinary branchiæ, they have an apparatus ramifying like a tree, adhering to the superior branch of the third and fourth branchial arch, and which appears to constitute a sort of supernumary gills. Their viscera resemble those of other *Siluri*, and their branchial membrane has from eight or nine to thirteen or fourteen rays. The spine of their pectoral is strong and dentated, but there is none such in the dorsal; their body is naked and elongated, as well as their dorsal and anal. There is no spine in the dorsal. The caudal is distinct. All the species known have eight cirri, and inhabit

* *Silurus militaris*, Bl. 362.

† *Sil. inermis*, Bl. 363, Seb. III, xxix, 8;—*Pimel. silondia*, Buchan. VII, 50.

N. B. The *Silurus ascita*, L., Ad. Fred., pl. xxx, f. 2, is nothing else than a common *Pimelodus* quitting the egg, the yolk of which has not yet completely entered the abdomen. Linnæus took this yolk for an ovary, and Bloch has paraphrased his mistake. It was also, through an error of the press, that Linnæus is made to place four cirri on the upper jaw—his figures exhibit them on the lower one.

‡ *Silurus costatus*, L., Bl. 376, and Gronov. V, 1, 2, which is also the *Cataphractus americanus*, Catesb., Suppl. IX, usually quoted as *Sil. cataphractus*;—*Sil. carinatus*, Lacép., which appears to me the same as Gronov. III, 4 and 5, generally cited also as the *S. cataphractus*, and as the *Klip-bagre*, Marcgr. 174, thus reducing the *S. cataphractus* to nothing.—*Doras granulosus*, Valenc., App. Humb. Zool. Obs. II, 133.

§ *Doras niger*, Valenc., loc. cit., or *Corydoras edentulus*, Spix, V;—*Dor. oxyrhynchus*, Val., Ib.

the Nile, the Senegal, and some rivers in Asia. Their flesh is indifferent or bad.

Some of them, the MACROPTERONOTES, *Lacép.*, CLARIAS, *Gronov.*, have but a single radiated dorsal.

One of these, the *Sharmuth*, or *Black-Fish*, *Silurus anguillaris*, Hasselq. and L., is common in Egypt and in Syria, constituting in the latter a considerable article of food *.

Others have a radiated dorsal, and a second one that is adipose †.

Plotosus, *Lacép.*,

Are characterized by a second radiated dorsal, which, as well as the anal, is very long, both of them uniting at the caudal to form a point as in the Eel; lips fleshy and pendent; the mouth armed in front with conical teeth, behind which are globular ones, those of the upper jaw belonging to the vomer; the body and head enveloped by a thick naked skin; nine or ten rays in the branchial membrane. The species known are from the East Indies. They have eight cirri; behind the anus and the fleshy and conical tubercle common to all the Siluri, is another fleshy and ramified appendage, whose functions must be very singular.

Some of them have large and dentated dorsal and pectoral spines ‡.

In others they are almost hidden under the skin §.

Callichthys, *Lin.*, in his first editions.—CATAPHRACTUS ||, *Lacép.*

Have the sides of the body almost entirely mailed in four ranges of scaly plates, and also a compartment of these plates on the head; but the end of the snout is naked, as well as the inferior surface of the body; a single ray in the anterior edge of the second dorsal; the pectoral spine strong, but the dorsal feeble or short. The mouth is but slightly cleft, and the teeth are almost insensible; four cirri; eyes small and on the sides of the head. These fishes can crawl about out of water for some time like the Eel.

The pectoral spine of some is simply rough ¶; in others it is dentated as in most of the Siluri **. The

MALAPTERURUS, *Lacép.*,

Are distinguished from all the true Siluri, by the absence of the radiated fin on the back, by their having only a small adipose one on the tail, and by the total deficiency of a spine in the pectorals, whose rays are entirely soft. The head, as well as the body, is covered with a smooth skin; the

* Add, *Macropt. magur*, Buchan. XXVI, the same as the *Silurus* called *anguillaris* by Patr. Russel, 168;—*Sil. Batrachus*, Bl. 370, 1, which may be the same as the *Macropteronote brun*, Lac. V, ii, 2;—the *Hexacircine*, Id. Ib. 3, has only six cirri; but it rests merely on Chinese drawings.

† The *Halé* (*Heterobranchus bidorsalis*), Geoff. Eg. Poiss. du Nil, pl. xvi, f. 2.

‡ *Platystacus anguillaris*, Bl. 373, 1; Renard, I, fol. 3, f. 19.

§ *Plotosus cæsius*, Buchan. XV, 44.

|| N. B. Bloch, in his genus CATAPHRACTUS, includes Doras and Callichthys.

¶ *Silurus callichthys*, Bl. 377, 1.

** A new species.

teeth are small and crowded, and arranged in a broad crescent both above and below; there are seven rays in the branchiæ, and the jaws and viscera resemble those of a *Silurus*. The only species known is that with six cirri, with a head smaller than the body, which, in its anterior part, is swelled out; it is the celebrated fish

M. electricus;—*Silurus electricus*, L.; *Silure Electrique du Nil et du Senegal*, Geoff., Poiss. d'Eg. pl. xii, f. 1; Brouss., Acad. des Sc. 1782; the *Raasch* or *Thunder* of the Arabs, which, like the *Torpedo* and *Gymnotus*, communicates electric shocks. The seat of this power seems to be in a particular tissue, situated between the skin and the muscles, and presenting the appearance of a fatty cellular tissue abundantly furnished with nerves. From the Nile and the Senegal.

PLATYSTACUS*, Bl.—**ASPREDO**, L., in his 4th and 6th editions.

These fishes present very singular characters in the flattening of their head and the widening of the anterior portion of their trunk, which chiefly results from that of the bones of the shoulder; in the proportional length of their tail; in their small eyes, placed on the superior surface; in their intermaxillaries under the ethmoid, directed backwards, and provided with teeth on the posterior edge only; and finally and principally, in the fact that they are the only bony fishes known which have no power of motion whatever in their operculum, a circumstance that is owing to the pieces which should compose it being soldered to the bone of the tympanum and to the preoperculum. The branchial aperture consists in a simple slit in the skin under the external edge of the head; the membrane, which has five rays, adhering everywhere else. The lower jaw is transverse, and the snout projected beyond it. The first pectoral ray is more strongly dentated than that of any other *Silurus*; there is but one dorsal on the anterior part of the back, the first ray of which is not very strong; the anal, on the contrary, is very long, and extends under the whole of the tail, which is long and slender.

But few species are known, and they have six or eight cirri; it is somewhat remarkable, that when the latter number prevails, one pair is attached to the base of those on the maxillaries; the four of the lower jaw are disposed in pairs, one behind the other†.

* **ASPREDO**, L., fourth and sixth edit.—Under this name of **PLATYSTACUS**, Bloch includes *Plotosus* and *Aspredo*. Lacépède leaves the latter with the *Siluri*, but makes a distinct genus of the former.

N.B. We must separate from the whole of this great genus *SILURUS*: 1st, the *Sil. cornutus*, Forsk., p. 66, on which the genus *Macroramphose*, Lac., is founded; it is nothing else than *Centriscus scolopax*, L.; 2d, the genus *POGONATUS*, Commers. and Lac. The first species is nothing more than the *pogonius*, Lac. II, xvi, 2, and III, p. 138, and consequently of the family of the *Sciænæ*; the other, *Pogonatus auratus*, evidently belongs to the genus *Umbrina*; 3d, the genus *Centranodon*, Lac., or *Silurus imberbis*, Houttuyn, Ac. Haarl. XX, 2, 338; it cannot possibly be a *Silurus*, as it has scales, spines on the opercula, the first dorsal spinous, &c. It is probably allied to the *Perches*, though Bloch, Schn. p. 110, very gratuitously arranges it among the *Sphyrænæ*.

† *Silurus aspredo*, L.; *Platystacus laevis*, Bl., Sch. III, xxix, 9 and 10;—*Platys. cotylephorus*, Bl. 372;—*Silurus hexadactylus*, Lac. V, p. 82.—The *Platystacus verrucosus*, Bl. 373, 3, differs from the others in having a shorter anal and tail.

Some of them are found with globules, which appear to be their eggs, adhering to the thorax by pedicles.

LORICARIA, *Lin.*,

So called on account of the angular and hard plates in which the head and body are completely mailed, are otherwise distinguished from the mailed Siluri, such as the *Callichthys* and the *Doras*, by their mouth being opened under the snout. This mouth is most analogous to that of a *Synodontis*; small intermaxillaries suspended under the snout, and transverse disunited mandibularies support long, slender, and flexible teeth, terminating in a hook; a broad, circular, membranous veil encircles the opening, and the pharyngeal bones are furnished with numerous teeth, as if paved. The true opercula are immoveable, as in *Aspredo*, but two small, external, moveable plates, appear to supply their place. There are four rays in the membrane. Strong spines constitute the first rays of the dorsal, pectorals, and even of the ventrals. They have neither cæca nor natatory bladder. They may be divided into two subgenera.

HYPOSTOMUS, *Lacép.*,

Have a second small dorsal furnished with a single ray, as in *Callichthys*; the labial veil is simply papillate, and is provided with a small cirrus on each side; no plates on the belly; the intestines, spirally convoluted, are as slender as thread, and twelve or fifteen times longer than the body. From the rivers of South America*.

LORICARIA, *Lacép.*,

Have only a single dorsal, forward; edges of the labial veil furnished with several cirri, and occasionally bristled with villosities; under part of the abdomen covered with plates; intestines of a moderate thickness †.

The fourth family of the Abdominal Malacopterygians,

FAMILY IV.

SALMONIDES.

The Salmonides, according to Linnæus, form only one great genus, very distinctly characterized by a scaly body, and a first dorsal with soft rays, followed by a second one small and adipose, that is to say, formed of skin filled with fat, and unsupported by rays.

These are fishes with numerous cæca and a natatory bladder; nearly all of them ascend rivers, and are highly esteemed. They are naturally

* *Loricaria plecostomus*, L., B. 374;—*Hyp. etentaculatum*, Spix, IV.

† *Loricaria cataphracta*, L., or *L. cirrhosa*, Bl. Schn., and *setigera*, Lacép., Bl. 375, 1, 2;—*Loricaria rostrata*, Spix, III;—*Rinelepis aspera*, Id. II;—*Acanthicus hystrix*, Id. I.

voracious. The structure and armature of the jaws are singularly various. This great genus,

SALMO, *Lin.*,

Must be subdivided as follows:—

The Salmon, properly so called, or rather the Trouts,

SALMO, *Cuv.*,

Have a great portion of the edge of the upper jaw formed by the maxillaries; a range of pointed teeth in the maxillaries, intermaxillaries, palatines and mandibularies, and a double one on the vomer, tongue, and pharyngeals; so that of all fishes it is the most completely furnished with teeth. In the old male, the end of the lower jaw is bent up towards the palate, where a cavity receives it when the mouth is closed. Every body is familiar with their forms: their ventrals are opposite to the middle of the first dorsal, and the adipose to the anal. There are ten branchial rays, or thereabouts. There is one flexure in the long and narrow stomach, which is followed by very numerous cæca: the natatory bladder extends from one end of the abdomen to the other, and communicates above with the œsophagus. The body is usually spotted, and the flesh good. These fishes ascend rivers to spawn, leaping over cataracts, &c., and are even found in the brooks and small lakes of the highest mountains.

S. salar, L., Bl. 20. (The Salmon). The largest species of the genus, with red flesh and irregular brown spots, which soon disappear in fresh water; the cartilaginous hook formed by the lower jaw is inconsiderable even in the old male. From all the Arctic seas, whence it enters the rivers in the spring. The value of this fishery in all northern countries is well known.

S. hamatus, Cuv.; Bl. 98; *Le Becard*. A whitish ground, spotted with red and black; snout of the male narrowed into a point, and the hook of the lower jaw much more strongly marked than in the salar. Its teeth are stronger and its flesh red, but leaner, and not so much esteemed. Taken at the mouth of rivers in Europe.

S. Schieffermulleri, Bl. 133; *La Truite de Mer*. Less than the salar, with longer and more slender teeth; flanks sprinkled with little crescent-shaped spots on a silvery ground: flesh yellow. Numbers of this species are sent to Paris during the summer.

S. hucho, L.; the *Hucho* of the Danube and its tributaries, Bl. 100, and better, Meidinger, 45. Nearly as large as the salar, differing but little from the preceding in its spots, but has a more pointed snout and much stronger teeth.

With respect to the remaining river Trouts, it may be said that they are found in all the clear streams of Europe, and particularly among the mountains, of very different colours and sizes, among which several naturalists have thought they could detect various species, while others affirm that these are mere varieties, resulting from age, nourishment, and especially from the waters in which they sojourn; this supposition, however, is, I think, stretched beyond the bounds of probability.

S. lemanus, Cuv. The great Trout of the lake of Geneva, which is also found in some neighbouring ones; head and back sprinkled with small round and blackish spots on a whitish ground; the flesh white; individuals are sometimes taken, weighing from forty to fifty pounds.

S. trutta, L.; Bl. 21. (The Salmon Trout). Ocellated spots, or spots shaped like an X, the upper ones sometimes surrounded with a circle of a lighter hue; many of these spots on the opercula and adipose fin; flesh reddish. The finest specimens of this species are taken from rivulets of clear water, which directly empty themselves into the sea, but it is found at all heights.

S. fario, L., Bl. 22. (The Common Trout). Smaller; brown spots on the back, red ones on the flanks, surrounded by a lighter coloured circle, but varying infinitely as to the tint of the ground, which is from a white and a golden yellow to a deep brown; flesh white; common in every brook whose waters are clear and rapid.

S. punctatus, Cuv.; *S. alpinus*, Bl. 104, (The Dotted Alpine Trout), but not the *alpinus* of Lin.; the *Carpione* of the lakes of Lombardy? Dotted with small black and red points; flesh delicious; it is found all round the Alps.


S. marmoratus, Cuv. (The Marbled Trout of the lakes of Lombardy). Irregular, close, brown spots and streaks, so intermixed as to resemble a kind of marbling, &c.; from the lakes of Lombardy. Naturalists agree in separating the

S. salvelinus, L.; Meidinger, 19, under the name of *alpinus*; *Truite rouge*; (the *Char* of the English). Red spots on the flank; orange abdomen; anal and pectorals red, their first ray thick and white(a).

S. alpinus, L.; Bl. 99; Meidin. 22, under the name of *salvelinus*. Nearly the same colours; but the first rays of the inferior fins are not distinguished. This species fills the mountain lakes of Lapland, &c., and constitutes an invaluable supply of food to the inhabitants of that country during the summer.

There is another small trout found in European rivers, the *Samlet* of the English; *Saumoneau* of the Rhine; Penn. Ill. Brit. Zool., pl. lix, 1, which many consider a distinct species. The greenish of the back and the white of the belly form zigzags, in each of which is a red spot; it is a small, but delicious fish.

S. umbla, L.; Bl. 101; *L'Ombre Chevalier*. Smaller scales and finer teeth than in either of the others; the spots more strongly

 (a) The late Sir Humphrey Davy, who paid great attention to the anatomical structure of those fishes, which are of greatest interest to the angler, suggested once the propriety of establishing a new species, which would form a link between *S. salvelinus* and *S. fario*. The new species is called the *Gillaroo*, and is found in the lake of Loch Con, in the north-west of Ireland. He describes its appearance to be nearly that of the ordinary Trout, except that it has more of the red spots, and also that it has a yellow or golden-coloured belly and fins, and that it is a broader and thicker fish. But its great peculiarity is its stomach, which is large and thick, and somewhat indurated, and generally containing small shell fish.—ENG. ED.

marked and frequently wanting; flesh fatter and white; resembling that of an eel. The Umbla of the lake of Geneva is particularly celebrated* (a).

OSMERUS, *Artédi*.

The Smelts have two ranges of separated teeth in each palatine, but only a few in front on the vomer; the general form is that of a trout, but there are only eight rays in the branchiæ. The body is without spots, and the ventrals correspond with the anterior edge of the first dorsal. Taken in the ocean and at the mouths of large rivers.

O. eperlanus; *Sal. eperlanus*, L., Bl. 28, 2. (The Smelt). The only species known; it is small, and ornamented with the most dazzling silvery and light-green tints; an excellent fish for eating.

MALLOTUS, *Cuv.*,

With the cleft mouth of the preceding, have only teeth dense as the pile on velvet, in the jaws, palate and tongue; eight branchial rays; the body elongated and covered with small scales; the first dorsals and ventrals posterior to the middle; particularly distinguished by large round pectorals, which almost meet beneath.

But a single species is known, *Salmo grænelandicus*, Bl. 381; the *Capelan*, Duhamel, Sect. I, pl. xxvi; *Clupea villosa*, Gmel. A small fish employed as a bait in the Cod fisheries. The flank of the male during the spawning season is marked with a broad band, furnished with long, narrow, and raised scales, resembling hairs.

THYMALLUS†, *Cuv.*

Have the structure of the jaw similar to the Trouts: the mouth, however, is but slightly cleft, and the teeth are extremely fine; first dorsal long and elevated; it has larger scales, which also serve as a mark of distinction from the Trout, which this fish resembles in habits and delicacy of flesh.

The stomach is a very thick sac; seven or eight rays in the branchiæ.

T. vulgaris; *Salmo thymallus*, L.; Bl. 24. (The Grayling). First dorsal as high as the body, and twice as long as it is high,

* Besides these Salmons and Trouts which are found in Europe, several others have been described by American and Russian naturalists, but they have not been sufficiently compared with the former, so that even Pallas expresses doubts with respect to some of his species. We will endeavour to settle their synonymes in our Ichthyology, but the extent of the details requisite for that purpose prevents us from attempting it here; we shall also in that work describe several species from North America, some of which have been pointed out by Mitchill, Lesueur, Rafinesquë, Richardson, &c.

† Artedi comprehended both the Hymalli and Coregoni in his genus COREGONUS.

§ (a) The Salmon rivers in Great Britain are,—in England, the Derwent, the Hadder, the Conway, several streams in Devonshire and Wales, rivers in Northumberland, the Tyne, Coquet, and Till; in Scotland, the Tweed, Tay, Dee, Don, Spey, Brora, Ewe, Helmsdale, Laxford; in Ireland, the Erne, Moy, Bann, Bush, Blackwater, Shannon.—ENG. ED.

spotted with black and sometimes with red; brownish, longitudinally streaked with blackish; an excellent fish for eating* (a).

COREGONUS, Cuv.

The Lavarets have the mouth as in the preceding subgenera, and more feebly armed, as it is frequently edentated; scales still larger; length of the dorsal less than the height of its anterior portion. Several very similar species are found in Europe; one of them, however,

C. oxyrhynchus; *Salmo oxyrhynchus*, L.; Bl. 25, under the false name of *Lavaret*, the *Houting* or *Hautin* of the Belgians, is easily distinguished by a soft prominence at the end of the snout. From the North Sea and the Baltic, where it pursues the Herring. It is also taken in the Scheldt, in the lake of Haarlem, &c.†

C. marcenula; *Salmo marcenula*, Bl. 28, f. 3; *S. albula*, Ascan., pl. xxix. (The Vemme). Strongly characterized by the lower jaw, which projects beyond the upper one‡.

The others have an obtuse snout, as if truncated; it is extremely difficult, however, to assign to them precise characters. Such are

C. marcena; *Salmo marcena*, Bl. 27. (The Marene). From the lakes of Brandebourg; its snout, although obtuse, extends beyond the mouth.

C. Wartmanni; *Salmo Wartmanni*, Bl. 105. (The Waurtmaune, or Lavaret). From the lakes of Bourget, Constance, the Rhine, &c. The snout is truncated even with the front of the mouth, the head is shorter in proportion, and the form longer and more slender.

C. fera, Jurine, Mem. de la Soc. Phys. of Geneva, III, part I, pl. vii. (The Fera). From the lake of Geneva, and some others; it is higher than the Wartmaune, and has larger fins.


C. hyemalis, Jurine, Ib., pl. viii. (The Gravanche). From the lake of Geneva, where it is found in the winter only; its head is thicker, and its fins are larger in proportion than in the fera.

C. palæa, Cuv. (The Black Palæa). From the lake of Neuf-

* Add, *Coregonus signifer*, Richardson, I, Voy. Capt. Franklin, p. 26;—*Cor. thymalloides*, Id.

† The genus *TRIPTERONOTUS*, Lacép., is founded on a bad figure of this *Houting* sent to Rondelet (Rondel. 195), to which, by some mistake, three dorsals had been given—that genus must consequently be suppressed. The very improper name of *Albula nobilis* was transferred to it by Schoenefield, and Linnæus and Artdi confounded it with the *Coregonus*, an example followed by Bloch. The *Salmo thymallus latus*, Bl. 26, appears to be a variety of it in the spawning season.

‡ Add, *Salmo clupeoides*, Pall.

 (a) The Grayling is one of the most interesting objects of the pursuit of the British angler; because, perhaps, it is a rare fish, and has been said to have been brought over to this country by the monks in antient times. It has in foreign countries the name of the “flower of fishes” given to it, according to popular tradition by St. Ambrose, on account of its agreeable odour. The angler, in order to take the Grayling, usually employs small flies of the Ephemeræ or Phryganæ families: the imitation of a grasshopper is found likewise to be an irresistible bait.—ENG. ED.

chatel; higher than any of the preceding species, particularly at the nape, and deeply coloured.

C. sikus, Cuv.; Ascan., pl. xxx, under the name of *Lavaret*. (The Sik) (*a*). From the rivers of Norway; the snout is prominent as in the maræna, but the body is narrower and browner*.

ARGENTINA, *Lin.*

The Argentines have the mouth small and jaws without teeth, as in *Thymallus*, but the mouth is depressed horizontally; the tongue is armed, like that of the Trouts, &c., with strong hooked teeth, and there is a transverse range of small ones before the vomer. There are six rays in the branchiæ, and the intestines differ but slightly from those of the Trout.

A. sphyrcæna, L., Cuv.; Mém. du Mus. I, xi. The only species known is from the Mediterranean; its natatory bladder is extremely thick, and singularly loaded with that silvery substance (nacre), which is so remarkable in fish; it is employed for colouring pearls. The stomach is remarkable for its black colour†.

Artedi and several of his successors have united all the Salmonides, which have not more than four or five rays in the branchiæ in the sub-genus CHARACINUS; but there is a sufficient difference in their figure, and particularly in their teeth, to warrant a still greater subdivision. They all, however, have the numerous cæca of the preceding Salmons, with the bladder of the Cyprinidæ, which is divided by a strangulation. The lingual teeth of the Trout are always wanting. We subdivide them as follows:—

CURIMATA, *Cuv.*,

Which have the whole external form of *Thymallus*; small mouth, the first dorsal above the ventrals, &c. Some of them resemble certain *Thymalli* in their teeth, which are only visible with the glass, and merely differ from them in the number of their branchial rays‡.

* Add *Salmo silus*, Ascan. XXIV;—*Coregonus albus*, Lesueur, Ac. Nat. Sc. Phil. I, p. 35;—*Cor. quadrilateralis*, Richardson, Franklin's Voy., pl. xxv, f. 2;—*Salmo peled*, Pall.

† This fish, which is most certainly the *Argentina* of Willoughby, 229, and, consequently, that of Artedi and Linnæus, always has a second adipose dorsal, as was observed by Brunnich, Icht. mass. 79; it should therefore have been placed among the Salmons. The *Argent. machnata*, Forsk., is the *Elops saurus*; this is also, most probably, the case with the *Argent. carolina* of Lin., although Catesby has omitted the dorsal in the fig. cited, Car. II, xxiv. The *Argentina* of Gronovius is an *Anchovy*, and that of Pennant a *Scopelus*,—*Serpe* of Risso. The *Argent. glossodonta*, Forsk., is a particular genus, the *Butirinus* of Commerson.

‡ *Salmo edentulus*, Bl. 380;—*C. unimaculatus*, Bl. 381, 3;—*S. tæniurus*, Valen. App. Humb. Zool. Obs. II, p. 166;—*S. curina*, Cuv., Marcgr. 156;—*Curimate* Gilbert, Quoy et Gaym. Voy. de Freyc. Zool., pl. xlviii, f. 1;—and probably, *S. cyprinoïdes*, Gronov., Zooph., No. 378. They are the PACU, Spix, XXXVIII and XXXIX. His ANODUS, XL and XLI, only differs in the mouth, which is rather more cleft.

(a) In England we call this fish the *Sheltk*, or fresh-water Herring; it is called *Vengis* in Scotland, and *Pollan* in Ireland.—ENG. ED.

Others have a range of teeth in each jaw, which are trenchant, directed obliquely forwards, the anterior ones longest, and, in a word, comparable to those of a *Balistes**. From the rivers of South America.

ANOSTOMUS, Cuv.,

Have the form of a *Thymallus*, and an upper and lower range of small teeth; the lower jaw turned up in front of the upper one, and gibbous, so that the little mouth resembles a vertical slit on the end of the snout †.

GASTROPELECUS, Bl.—SERPES, Lacép.,

Have the mouth directed upwards as in *Anostomus*; but the belly is compressed, projecting, and trenchant, owing to its being supported by ribs which terminate in the sternum; ventrals very small and far back; first dorsal over the anal, which is long; conical teeth in the upper jaw, trenchant and dentated ones in the other ‡.

PIABUCUS, Cuv.,

With the small head and slightly-cleft mouth of the *Curimatæ* have a compressed body, the ventral carina trenchant but entire, and a very long anal. The first dorsal is opposite to the commencement of the latter §. The

SERRA-SALMUS, Lacép.,

Already distinguished by that naturalist, is known by the compressed, high body, and the trenchant and serrated belly, to which characters must be added that of the triangular, trenchant and dentated teeth. The maxillary, wholly without teeth, passes obliquely over the commissure. There is frequently a horizontal spine in front of the dorsal.

The species known are all from the rivers of South America. It is said that they pursue ducks, and even men, while bathing, inflicting severe wounds with their sharp teeth||.

TETRAGONOPTERUS, Artédi,

Have the long anal, and trenchant, dentated teeth of the *Serra-salmi*, and the maxillary without teeth passing obliquely over the commissure; the mouth, however, is but slightly cleft, and the abdomen is neither carinated nor dentated ¶.

* *Salmo fasciatus*, Bl. 379;—*S. Fridericii*, Id. 378.

† *Salmo anostomus*, L., Gronov. VIII, 2.

‡ *Gastropelecus sternicla*, Bl. 97, 3.

§ *Salmo argentinus*, Bl. 382, 1; Marcgr. 170;—*S. bimaculatus*, Bl. 16;—*S. gibbosus*, Gronov., Mus. I, i. 4;—*S. melanurus*, Bl. 381, 2.

|| *Salmo rhomboides*, Bl. 383;—*Serras. piraya*, Cuv., Mém. Mus. V, pl. xxviii, f. 4;—*Serras. mento*, Id., Ib., f. 3;—*Serras. aureus*, Spix, XXIX;—*S. nigricans*, Id. XXX.

¶ *Tetragonopterus argenteus*, Arted., App. Seb. III, pl. xxxiv, f. 3, or *Coregonoides amboinensis*, Art., Spec. 44, improperly confounded with the *Salmo bimaculatus*;—*Chalceus fasciatus*, Cuv., Mém. Mus. V, pl. xxvi, f. 2;—*Serra-salmo chalceus*, Spix, XXXIII, 1.

CHALCEUS, Cuv.,

Have the same form of mouth, and the same trenchant and notched teeth as in the preceding subgenus, but the body is oblong and neither carinated nor dentated; very small, round teeth in the maxillaries*.

MYLETES, Cuv.

These fishes are remarkable for their very singular teeth, which resemble short triangular prisms, rounded on the ridge, and excavated on the superior surface of the crown by mastication, so that three salient points are formed there by the three angles. There are two ranges of these teeth in the intermaxillaries of the slightly cleft mouth, and a single one in the lower jaw, with two teeth behind; the palate and tongue, however, are smooth. The maxillaries placed on the commissure have no teeth.

Some of them have the elevated figure, the falciform vertical fins, forwardly inclined spine, and even the trenchant and notched abdomen of the *Serra-salmi*, to which, but for their teeth, we should certainly unite them. One of them even has a horizontal spine in front of the dorsal†. Very large ones, whose flesh is much esteemed, are found in America‡.

Others have an elongated form, the first dorsal being opposite to the interval between the ventrals and the anal. The species known are only found in Egypt§.

HYDROCYON, Cuv.,

Have the end of the snout formed by the intermaxillaries; the maxillaries commencing near the eyes, or before them, and completing the upper jaw. The tongue and vomer always smooth, but both jaws are furnished with conical teeth; a large suborbital, thin and naked like the operculum, covers the cheek.

Some of them have a compact range of small teeth in the maxillaries and palatines, their first dorsal corresponding to the interval between the ventrals and anal||. They inhabit rivers in the torrid zone; their flesh resembles that of the Carp¶.

Others have a double row of teeth in their intermaxillaries and lower jaw, and a single one in the maxillaries; but their palatines have none. Their first dorsal is above the ventrals**.

* *Chalceus macrolepidotus*, Cuv., Mém. Mus. IV, pl. xxi, f. 1;—*Ch. opalinus*, Id., Ib. V, pl. xxvi, f. 1;—*Ch. angulatus*, Spix, XXXIV.

† *Myletes rhomboïdalis*, Cuv., Mém. du Mus. IV, pl. xxii, f. 3.

‡ Add to the preceding species, *Myl. duriventris*, Ib., f. 2;—*M. brachypomus*, Ib., f. 1;—*M. macropomus*, Ib., pl. xxi, f. 3;—*M. paco*, Humb. Zool. Obs. II, pl. xlvii, f. 2.

§ The *Raïi* of the Nile, which is the *Cyprinus dentex*, L., Mus. Ad. Fred. and ed. XII, or the *Salmo dentex*, Hasselq., and the *S. niloticus*, Forsk., and which is thus twice found in Gmelin and his successors. It is the *Myl. Hasselquistii*, Cuv., Mém. Mus. IV, pl. xxi, f. 2.

|| It is for this reason that M. de Lacépède placed them among the Osmeri.

¶ *Salmo falcatus*, Bl. 385;—*S. odoe*, Id. 386;—*Hydrocyon falcirostris*, Cuv., Mém. Mus. V, pl. xxvii, f. 1;—*Hyd. hepsetus*, Cuv., or *Hydr. faucille*, Zool. Voy. de Freycin., pl. 48, f. 2.

** A new species from Brazil, the *Hydroc. brevidens*, Cuv., Mém. Mus. V, pl. xxvii, f. 1, or *Characius amazonicus*, Spix, XXXV.

Others again have only a single range in the maxillaries and lower jaw, the teeth being alternately very small and very long, the two second ones below in particular, which, when the mouth is closed, pass through two holes in the upper jaw. Their lateral line is furnished with larger scales, and the first dorsal corresponds to the interval between the ventrals and anal*.

There is a fourth sort, in which the snout is pointed and very salient; the maxillaries very short, and furnished, together with the lower jaw and the intermaxillaries, with a single compact range of very small teeth; their first dorsal corresponds to the interval between the ventrals and anal. The entire body is covered with strong scales†.

Finally, the only teeth possessed by others are those in the lower jaw and intermaxillaries; they are but few, strong, and pointed. Their first dorsal is above the ventrals. But a single species is known, and it inhabits the Nile‡.

CITHARINUS, Cuv.,

Are recognized by a depressed mouth, transversely cleft in the end of the snout, whose upper edge is wholly formed by the intermaxillaries, and where the small and dentated maxillaries only occupy the commissure; the tongue and palate are smooth, and the adipose fin is covered with small scales, as is the greater portion of the caudal. They inhabit the Nile.

Some of them have very small teeth in the upper jaw only, and an elevated body as in *Serra-salmus*; the abdomen, however, is neither trenchant nor indented§.

Others have several compact rows of numerous slender teeth, forked at the end, in both jaws; their form is more elongated||.

SAURUS, Cuv.,

Have a short snout; the mouth deeply cleft, opening far behind the eyes, edge of the upper jaw wholly formed by the intermaxillaries; sharp pointed teeth along the jaws, palatines, tongue, and pharyngeals, but none on the vomer; eight or nine, and, frequently, twelve or fifteen rays in the branchiæ. The first dorsal is a little behind the ventrals, which are large; scales on the body, cheeks, and opercula; viscera similar to those of a Trout. They are salt-water fishes, and extremely voracious.

One of them, *S. saurus*, L., Salv. 242, is found in the Mediter-

* Another Brazilian species, *Hydroc. scomberoides*, Cuv., Mém. Mus. V., pl. xxvii, f. 2, or *Cynodon vulpinus*, Spix, XXVI;—*Cynodon gibbus*, Id. XXVII.

† Another species from Brazil, the *Hydroc. lucius*, Cuv., Mém. Mus. V, pl. xxvi, f. 3, or *Xiphostoma Cuvieri*, Spix, XI.II.

‡ The *Roschal* or *Water-dog* of Forsk., 66, or *Characinus dentex*, Geoff. Poiss. d'Eg., pl. 4, f. 1, and Cuv., Mém. Mus. V, pl. xxviii, f. 1, but which is not, as Forskahl thought, the *Salmo dentex* of Hasselquist—that is the *raii*.

§ The *Serra-salme citharine*, or *Night Star* of the Arabs, Geoff., Poiss. d'Eg., pl. v, f. 2 and 3, (*Citharinus Geoffræi*, Cuv.);—*Salmo Cyprinoïdes*, Gronov., Mus. p. 378.

|| The *Characin nefasch*, Geoff., Ib., f. 1, or *Salmo ægyptius*, Gm.; it is the *Salmo niloticus* of Hasselquist, very different from that of Forskahl, which is the *raii*.

reanean*. The lake of Mexico produces a second, *S. mexicanus*, Cuv., which is nearly transparent. A third, equally diaphanous, with very long flexible teeth, some of which have a sagittiform termination, an extremely short snout, and very weak fins,—*S. ophiodon*, Cuv.; *Vana motta*, Russel, 171, is employed in India, when dried and salted, as a condiment†.

SCOPELUS, Cuv.—SERPES, Risso‡,

Have the mouth and branchiæ deeply cleft; both jaws furnished with very small teeth; edge of the upper jaw wholly formed by the intermaxillaries; tongue and palate smooth. The snout is very short and obtuse; there are nine or ten rays in the branchiæ, and besides the ordinary dorsal, which is opposite to the interval between the ventrals and anal, there is a very small one behind, in which vestiges of rays are perceptible.

These fishes are taken in the Mediterranean along with Anchovies, where they are called *Mélettes*. One of them, *Serpe Humboldt*, Risso, pl. x, f. 38, is remarkable for the lustre of the silvery points arranged along the tail and abdomen§.

AULOPUS||, Cuv.,

Combine the characters of the Salmon and Codfish; the mouth well cleft; the intermaxillaries, which form the whole of its upper edge, the palatines, the anterior extremity of the vomer and the lower jaw, furnished with a narrow band of teeth, resembling those of a card; the tongue and level part of the ossa palati rough. The maxillaries are large and edentated, as is the case with the greater number of the class. The ventrals are almost under the pectorals, their external rays being stout and only forked; the first dorsal opposite to the anterior half of the interval which separates it from the anal; twelve rays in the branchiæ; body, cheeks, and opercula, covered with large ciliated scales.

* Add, *S. saurus*, Bl. 384, which appears to me to differ from the Mediterranean species;—*Salmo foetens*, Bl. 384, 2;—*S. tumbil*, Bl. 400;—the *Osmère galonné*, Lac. V, vi, 1;—the *Salmone varié*, Id., V, iii, 3;—the *Osmère à bandes*, Risso, ed. I, p. 326;—*S. badi*, Cuv., (*Badi motta*), Russel, 172;—*Salmo myops*, Forster, Bl. Schn. p. 421;—*S. minutus*, Lesueur, Ac. Nat. Sc. Philad. V, part I, pl. v;—*S. conirostris*, Spix, XLIII;—*S. intermedius*, Id. XLIV;—*S. truncatus*, Id. XLV, and several new species to be described in our Ichthyology. N.B. *Esox synodus*, Gronov., Zooph. VII, 1, *Synodus synodus*, Schn., *Synode fascé*, Lac., appears to be nothing more than a *Saurus* which had lost its adipose fin; its extreme smallness renders it easily effected by friction or desiccation.

† The *Salmo microps*, Lesueur, Ac. Nat. Sc. Philad. V, part I, pl. iii, if not the same species, is at least a closely allied one. It forms the genus *HARPODON* of that naturalist, who considers it as having teeth in the vomer, but they are in the pharyngeals, and not in the vomer: the mistake has arisen from the extreme shortness of the snout.

‡ *Skopelos*, the Greek name of an unknown fish.

§ I believe this fish to be the same as the pretended *Argentina sphyraena* of Pennant, Brit. Zool., No. 156: thus it would also be found in our Ocean.—Add, the *Serpe crocodile*, Risso, p. 357;—the *Serpe balbo*, Id., Ac. of Sc. Turin, Vol. XXV, pl. x, f. 3.—But the *Serpe microstome*, p. 356, certainly belongs to another genus, and to the family of the Pikes.

|| *Aulopus*, the Greek name of some unknown fish.

One species, *Salmo filamentosus*, Bl., Berl. Schr. X, ix, 2, is found in the Mediterranean.

STERNOPTYX, *Herman*,

Constitute a genus of small fishes with an elevated and very compressed body, supported by the ribs; their mouth is directed upwards; their humerals form a trenchant crest in front, terminated below by a small spine, and the bones of the pelvis form another, also ending in a small spine in front of the ventrals, which are so small as to have escaped the notice of the first observer. There is a series of small fossulæ along each side of the pelvic crest, which has been considered as a festooned duplicature of the sternum, whence the name of Sternoptyx. Before their first dorsal is an osseous or membranous crest which belongs to the anterior interspinals, and behind that fin a slight membranous projection is visible, which represents the adipose fin of the Salmon; the sides of the mouth are formed by the maxillaries. Two species are found in the Atlantic, which may one day constitute the types of two separate genera.

S. diaphana, Herman, Naturforscher, Fasc. XVI, pl. 8; copied Walbaum, Arted. renov. tom. III, pl. 1, f. 2. Teeth small and crowded; five rays in the branchiæ; its form is singularly oblique, the mouth being out of a vertical line.

S. Olfersii, Cuv. Teeth hooked, and nine rays in the branchiæ. Both these species are taken in the warm parts of the Atlantic Ocean*.

The fifth family of the Abdominal Malacopterygians is that of

FAMILY V.

CLUPEÆ,

Herrings, which are easily recognized by their having no adipose fin; the upper jaw is formed, as in the Trouts, by intermaxillaries without pedicles in the middle, and by the maxillaries on the sides; the body is always covered with numerous scales, and in the greater number we find a natatory bladder and many cæca. A part only of the family ascend rivers. The

CLUPEA, *Lin.*,

Have two well-marked characters in the narrow and short intermaxillaries, that constitute but a small portion of the upper jaw, the sides of which are completed by the maxillaries, so that these sides are alone protractile; and in the inferior edge of the body, which is compressed, and where the scales are dentated as in the edge of a saw. The maxillaries

* Our descriptions are drawn from nature. Herman refused to allow his specimen branchial rays and ventrals, although it possesses both; it is still in existence at Strasbourg. We shall be more particular on this subject in our Ichthyology.

are divided into three pieces. The branchiæ are so much cleft, that all the fishes of the genus are said to die instantly when taken from the water. The sides of the branchial rays next to the mouth are pectiniform. The stomach is an elongated sac; the natatory bladder long and pointed, and the cæca numerous. Of all fishes, these have the finest and most numerous bones.

CLUPEA, Cuv.,

The Herrings, properly so called, have the maxillaries arcuated before, and longitudinally divisible in several pieces; opening of the mouth moderate: upper lip not emarginated.


C. harengus, L., Bl. 29, 1. (The Common Herring). This well-known fish has the teeth visible in both jaws; carina of the abdomen but slightly marked; suboperculum rounded; veins on the suborbital, preoperculum, and upper part of the operculum. The ventrals arise from under the middle of the dorsal; the length of the head is one-fifth of that of the whole fish, and by transferring backwards the measure of the distance from the snout to the first dorsal, it marks the middle of the caudal. There are sixteen rays in the anal.

This celebrated fish leaves the Arctic seas every summer, and descends in autumn on the western coast of France in numberless legions, or rather in solid shoals of incalculable extent, spawning on their way, and arriving at the mouth of the British Channel, in the middle of winter, in a very extenuated condition. Whole fleets are occupied in this fishery, which supports thousands of fishermen, salters, and dealers. The best are those taken in the North; such as are caught on the coast of Lower Normandy are lean, dry, and of a disagreeable flavour (*a*).

C. sprattus, Bl. 29, 2. (The *Mellet*, *Esprot*, *Harenguet*, or the Sprat of the English). The proportions of the Herring, but a much smaller fish; no veins on the opercula; a gilt band along the flanks in the spawning season*.

C. latulus, Cuv., Schonefeld, p. 41. (The *Blanquette*, the *Breiting* of the Germans, and the White-Bait of the English). The body more compressed, and the abdomen more trenchant than in the

* Artedi and his successors have confounded the Sprat with the Sardine.

 (*a*) The Herrings form their great rendezvous in the Arctic Circle, from which they begin to descend about April, and in general are off the Shetland Islands in May; but the principal shoal does not arrive in our latitudes until June. It is evident that this periodical migration is had recourse to by the Herrings for the purpose of depositing their spawn in warmer temperatures. According to Pennant's account, the great shoal is first divided in its course southward by the Shetland Islands, on arriving at which one wing takes its course to the eastern, the other to the western shores of Great Britain, each division having its respective leader to guide it. The fishery begins at the Hebrides, and the fishermen there make such good use of the opportunity, that they have made these islands the great Herring-fishery station. The division of the fish which proceeded to the west is again subdivided, one portion drifting itself into the Atlantic, the other coasting down the Irish Sea.—ENG. ED.

Herring; height of the body and length of the head each one-fourth of the whole length of the fish; the dorsal more forwards, the anal longer, and approaching nearer to the caudal. A very small fish, of the most brilliant silver colour, with a little black spot on the end of the snout * (a).

C. pilchardus, Bl. 406; and better, Will. pl. 1, f. 1. (The Pilchard of the English, the *Celan* of the French). About the size of the Herring, but with larger scales; the suboperculum square; radiated striæ on the preoperculum and operculum; the head shorter in proportion than that of the Herring, and the dorsal more forward, so that the distance from the snout to the dorsal does not reach the caudal. The ventrals arise from under the end of the dorsal; there are eighteen rays in the anal, and on each side of the caudal are extended two scales longer than the rest. It is preferred to the Herring, particularly on the western coast of England (b).

C. sardina, Cuv.; Duham., Sect. III, pl. xvi, f. 4. (The Sardine). So similar to the Pilchard, that the only perceptible difference is its inferior size. It is celebrated for the extreme delicacy of its flavour, and the numbers which are taken on the coast of Britany. It is also captured in the Mediterranean, where the Herring is unknown †. The

ALOSA, Cuv.,

Are distinguished from the Herrings, properly so called, by an emargination of the middle of the upper jaw; all the other characters are those of the Pilchard and Sardine.

* Species allied in form to the *latulus*: the *Cailleu*, (*Cl. clupeiola*, Cuv.), Duham., Sect. III, pl. xxxi, f. 3;—the *Sardine de la Martinique*, (*Cl. humeralis*, Cuv.), Duham., Ib., f. 4;—*Cl. melanura*, Cuv., Lacép. V, xi, 3, under the name of *Clupanodon Jussieu*, but the description of which belongs to fig. xi, 3, called a variety of the *Clupanodon chinensis*;—*Cl. coval*, Cuv., Russ. 186, &c.

† We may also separate from the true Herrings the *Jangartoo*, Russel, 191, or the *Clupea melastoma*, Schn.; and his *Ditchoee*, 192, which have the dorsal posterior to the ventrals, and a long anal.

§ (a) A great difference of opinion exists amongst British naturalists as to the true nature of the White-Bait of the Thames; Pennant considered this fish as an appendage to the Bleak (*Cyprinus alburnus*); Shaw regarded it as a Carp. Drs. Turton, Fleming, and Mr. Donovan, were of opinion that the White-Bait is the fry of the Shad, (*Clupea alosa*); and this impression had been universally received until 1828, when Mr. Yarrell commenced a minute anatomical examination of the fish. It is well known that the number of the vertebræ forms one of the most distinctive characters of fishes, and Mr. Yarrell sought accordingly if this number corresponded between the Shad and the White-Bait. In the numerous specimens examined by him of the latter, he uniformly found the number of the vertebræ to be fifty six, whilst in the Shad it was as invariably fifty-five.—ENG. ED.

§ (b) The Pilchard fishery is exclusively carried on on the coast of Cornwall, where the fishes are cured and dried, and nearly altogether exported to the Mediterranean. The apparatus employed for catching the fish is peculiar: it is called a "seine," and consists of three boats, the crews of which have the management of an immense net, that can take upwards of five millions of the fish in a single draught. Formerly there were bounties upon the Pilchards, as also on the Herrings; but they have been removed from both, a circumstance which has contributed to the decline of our British Channel fisheries. To this discouragement there is added, in the case of the Pilchard fishery, an increased import duty imposed by the government at Naples, which has hitherto been the principal market for this fish.—ENG. ED.

A. vulgaris; *Clupea alosa*, L., Duham., Sect. III, pl. 1, f. 1. (The Shad). Becomes a much larger and thicker fish than the Herring, attaining a length of three feet; is distinguished by the absence of sensible teeth, and by an irregular black spot behind the gills. It ascends the rivers in spring, and is then highly esteemed; when taken at sea it is dry and of a disagreeable flavour.

A. finta, Cuv.; *Cl. finta*, Lac.; the *Venth* of the Flemish; *Agone* of Lombardy; *Lachia*, *Alachia* of Italy, &c. More elongated than the Shad, and has well-marked teeth in both jaws; five or six black spots along the flank. It is found as far as the Nile, but is greatly inferior in its taste*.

CHATOESSUS, Cuv.

The Chatoessi are true Herrings, whose last dorsal ray is prolonged into a filament. In some the jaws are equal, and the snout is not prominent; the mouth small and without teeth†.

In others the snout is more prominent than the jaws, their mouth also is small. The superior combs of the first branchia unite with those of the opposite side, forming a very singular pennated point under the palate‡.

Next to the true Herrings come some foreign genera, which approach them in the trenchant and indented abdomen.

ODONTOGNATHUS, Lacép.—GNATHOBOLUS, Schn.,

Have a strongly compressed body, with very acute dentations, as far as the anus; the anal long and low; a very small brittle dorsal, which is almost always destroyed; six rays in the branchiæ; the maxillary somewhat extended into a point, and armed with two small teeth directed forwards; ventrals have never been perceived on it§.

But a single species is known, that from Cayenne, the *Odontognathe aiguillonné*, Lacép. II, vii, 2, which resembles a small Sardine in form, but is still more compressed.

* Bloch, pl. 30, under the name of *Alosa*, gives a *finta*, the posterior part of whose abdomen had been deprived of scales. Add, *Cl. vernalis*, Mitch. V, 9;—*Cl. æstivalis*, Id. V, 6;—*Cl. menhaden*, Id. V, 7;—*Cl. matowaka*, Id. V, 8;—*Cl. palasah*, Cuv., Russ. 198;—*Cl. kelée*, Id. 195;—*Clupanodon ilisha*, Ham. Buch. XIX, 73;—*Clupan. champagne*, H. Buch. XVIII, 74, and his other species, p. 246—251.

The genera, *POMOLOBUS*, *DOROSOMA*, *NOTEMIGONUS* of Rafin., (Ohio fishes), must approach the *Alosa* more or less; they have no teeth, but we are not sufficiently acquainted with them to assign their definitive situation.

† The *Cailleu-tassard* of the Antilles, (*Clup. thrissa*, Bl. 404, f. 3), Duham., Sect. III, pl. xxxi, f. 3;—*Peddakome*, Russ. 197;—*Megalops oglina*, Lesueur, Ac. Nat. Sc. Phil. I, 359;—*M. notatus*, Id. 36;—*M. cepedianus*, Id., Ib.

‡ *Clupea nasus*, Bl. 427, or *Kome*, Russ. 196.

§ M. de Lacépède having only seen one badly preserved specimen, thought that its maxillaries naturally projected in front of the mouth like two horns; this, however, was an accidental circumstance, for they are placed in this genus as in all the others. It is from this erroneous idea that he gave it the name of *Gnathobolus*, i. e. shooting out its jaws.

PRISTIGASTER, Cuv.,

Have the head and teeth of an ordinary Herring; four branchial rays, and apparently no ventrals; the abdomen strongly compressed, forming a trenchant, convex, and dentated arch. From both Oceans*.

NOTOPTERUS, Lacép.

The Notopteri, which for a long time were placed among the Gymnoti, approach nearer to the Herrings. Their opercula and cheeks are scaly; their suborbitals, the lower part of their preopercula and interopercula, the two ridges of their lower jaw, and the carina of their abdomen, dentated; both jaws and the palatines armed with fine teeth; most of the upper jaw formed by the maxillary; the tongue furnished with strong hooked teeth. The branchiostegal membrane has a single, but strong and bony ray; two almost imperceptible ventrals are followed by a very long anal, which occupies three-fourths of the length, and is united, as in *Gymnotus*, with the fin of the tail; on the back, opposite to the middle of this anal, is a small dorsal with soft rays.

A species is known which inhabits the fresh-water ponds of India; it is the *Gymnotus notopterus*, Pall. Spic. VI, pl. vi, f. 2; the *Clupea synura*, Sch. 426; or the *Notoptère kapirat*, Lacép.†

ENGRAULIS, Cuv.

The Anchovies form a genus sufficiently distinguished from that of the Herrings by the mouth, which is cleft far behind the eyes, and by the greater opening of the branchiæ, which have twelve or more rays; a little pointed snout, under which are fixed the very small intermaxillaries, projects in front of the mouth; maxillaries straight and elongated.

The common species have not even the trenchant abdomen; their anal is short, and the dorsal corresponds to the ventrals.

E. encrasicholus, Cl. *encrasicholus*, L.; Bl. 302. (The Common Anchovy). A span long; back a bluish brown; flanks and belly silvery; is taken in countless numbers in the Mediterranean, and as far as Holland, and is prepared for sauce after the head and intestines are removed.

E. meletta, Cuv.; the *Mélet*, Duham., Sect. VI, pl. iii, f. 5. A small species with a less convex profile; also from the Mediterranean.

E. edentulus, Cuv.; Sloane, Jam. II, pl. 250, f. 2‡. A species without any teeth. America produces several others equally remarkable.

* *Pr. taradoore*, Cuv., Russ. 193;—*Pr. cayanus*, Cuv., a new species.

† It is truly the *Sea-Tench* of Bontius, Ind. 78, but not the *Capirat* or *Pangais*, Ren., feuille 16, f. 90, which has long ventrals.

‡ Add, *Engr. lemniscatus*, Cuv., or *piquitinga*, Marcgr. 159, Spix, XXIII;—the *Stolèphore commersonien*, Lacép. V, XII, 1, or *Nattoo*, Russ. 187, probably the *Atherina australis*, White, p. 196, f. 1;—the *Clupée tuberculeuse*, Lacép. V, p. 460.

N.B. His *Cl. raie d'argent* does not differ from his *Stolèphore*.

In a second kind, as in the true Herrings, the body is compressed, and the abdomen trenchant and dentated*. The

THRYSSA, Cuv.,

Only differ from the Anchovies with a dentated abdomen, by the extreme prolongation of the maxillaries. The only species known are from the East Indies†.

MEGALOPS, Lacép.,

Have the jaws formed like those of the true Herrings, which they also resemble in their general form, and the disposition of their fins; but their abdomen is not trenchant, nor is their body compressed; their jaws and palatines are furnished with teeth small and crowded like the pile on velvet; their branchial rays are much more numerous (from twenty-two to twenty-four), and the last ray of the dorsal, and frequently of the anal, is lengthened into a filament as in the Chatoessus.

America produces a species, the *Savalle* or *Apalike*, *Clupea cyprinoides*, Bl. 403, from Plumier; *Cl. gigantea*, Sh.; *Camaripu guaçu*, Marcgr., which attains the length of twelve feet, and has but fifteen rays in the dorsal; there is a filament also on the anal. There is a second in India, the *Megalope filamenteux*, Lacép. V, xiii, 3, improperly confounded with the first, under the false name of *Apalike*, Russ. 203. It has seventeen dorsal rays.

ELOPS, Lin..

The Elops have all the characters of a Megalops, but the dorsal filament is wanting, and their form is somewhat more elongated: as many as twenty rays and upwards are counted in the branchial membrane; the superior and inferior edge of the caudal armed with a flat spine.

Species are found in both hemispheres‡.

BUTIRINUS, Commers.,

Have the jaws formed like those of a Herring; the body round and elongated, as in Elops and Megalops, and the prominent snout of an Anchovy. The mouth is slightly cleft, small crowded teeth in the jaws, and twelve or thirteen branchial rays; and what constitutes their peculiar character

* *Clupea atherinoides*, Bl.;—*Cl. telara*, Buch. II, 72;—*Cl. phasa*, Id., p. 240;—*Poorwa*, Russ. 194.

† *Clupea setirostris*, Brousson, Dec. Ichth., copied Encycl. 316;—*Cl. mystus*, or *Pedda poorawah*, Russ. 190;—*Cl. mystax*, Bl. Schn. 83;—*Poorawah*, Russel, 189.

‡ The Elops of the Indian Ocean is the *Argentina machnata* of Forskahl, and the *Mugil salmoneus* of Forster, Bl., Schn., p. 121; although he gives it but four branchial rays, I have ascertained this by the figure. It is also the *Jinagow*, Russ. 170, and the *Synode chinois*, Lacép. V, x, 1. The American Elops is the *Mugil appendiculatus* of Bosc, or the *Mugilomore Anne-Caroline*, Lacép. V, 398; the *Pounder*, Sloane, Jam. II, p. 250, f. 1. The *Argentina carolina*, L., is also the same fish, although he quotes but a single bad figure, Catesb. II, xxiv; but the *Saurus maximus*, Sloane, II, pl. 251, 1, usually cited as synonymous with the Elops, is of a totally different genus. It is the *Esox synodus*, L., *Synode fascé*, Lacép., or, what is the same thing, one of our *Sauri* that had lost its adipose fin.

is, that their teeth are as if paved, being rounded, and closely set on the tongue, vomer, and palatines. From both oceans.

The Elops and Butirini are beautiful, silvery fishes, with numerous bones and cæca, that attain a considerable size*, affording an excellent dish.

CHIROCENTRUS, *Cuv.*,

Have the edge of the upper jaw, as in the Herring, formed by the intermaxillaries, and the sides by the maxillaries, which are united with them; both, together with the lower jaw, are furnished with a row of stout conical teeth, the two middle anterior upper ones of which, as well as all those of the lower jaw, are of extraordinary length. The tongue and branchial arches are bristled with teeth, resembling those of a card, but there are none on the palatine bones or on the vomer. There are seven or eight rays in the branchiæ, the external ones very broad. Above and beneath each pectoral is a long, membranous, and pointed scale, and the pectoral rays are very hard; the body is elongated, compressed, and trenchant, but not dentated beneath; the ventrals are extremely small, and the dorsal is shorter than the anal, opposite to which it is placed. The stomach is a long, slender, and pointed sac, the pylorus is near the cardia, and the natatory bladder long and narrow. I find no cæca.

But a single species is known; it is of a silver colour, and inhabits the Indian Ocean†.

HYODON, *Lesueur.*

The Hyodons have the form of a Herring; abdomen trenchant but not dentated: the dorsal opposite to the anal; eight or nine rays in the branchiæ, and hooked teeth in the jaws, vomer, palatines and tongue, as in the Trouts.

The species known inhabit the fresh waters of North America‡.

ERYTHRINUS, *Gronov.*

The Erythrins, like all the rest of the family, have small intermaxillaries, and a great portion of the sides of the upper jaw formed by the maxillaries; a range of conical teeth occupies the edges of each jaw, and

* The *But. banana*, Commers., Lacép. V, 45, which is also his *Synode renard*, Id. V, pl. viii, f. 2, or *Esox vulpes*, L., Catesb. II, i, 2, cop. Encycl. 294, is a fish found on the Atlantic coast of America, the same as the *Ubarana* of Marcgr., Brazil, 154, or *Clupea Brasiliensis*, Bl., Schn.; as the *Amia* of Brown; as the *Albula gonorynchus*, Bl., Schn., p. 432, or *Albula Plumieri*, Id. pl. 86; as the *Clupée macrocephale*, Lacép. V, xiv, 1, and as the *Macabi*, Parra, pl. 35, f. 4, or *Amia immaculata*, Bl., Schn. 451. Spix has two of them, pl. xxiii, 2, and xxiv. The *Butirinus* of India is the *Argentina glossodonta*, Forsk., or *Argentine bonuk*, Lacép., the *Esox argenteus*, Forst., App. Bl. Schn. 396. Having seen the American species only, I am not yet well acquainted with their distinguishing characters.

† The *Esoce chirocentre*, Lacép. V, viii, 1, *sabre* or *sabran* of Commerson, which is the same fish as the *Clupea dentex*, Schn., p. 428, Forsk., p. 72, or as the *Clup. dorab*, Gm., and as the *Wallah*, Russ. 199. It is probably also the *Parring*, or *Chnees*, of the Moluccas, Ren. VIII, 55.

‡ *Hyodon clodulus*, Lesueur, Ac. Nat. Sc. Philad. I, pl. xiv, and p. 367;—*H. tergissus*, Id., Ib., p. 366.

among the anterior ones there are some larger than the others. Each of the palatines is provided with a plate of small and crowded teeth, and there are but five broad rays in the branchiæ. The head is round, obtuse, furnished with hard bones, and without scales. Indurated suborbitals cover the whole cheek. The body is oblong, slightly compressed, and covered with broad scales, like that of the Carp; the dorsal is opposite to the ventrals; the stomach is a wide sac, and there are numerous small cæca. The natatory bladder is very large.

They inhabit the rivers of hot climates, and their flesh is of an agreeable flavour*.

AMIA, *Lin.*

The Amiæ are closely related to the Erythrins in their jaws, teeth, and head, which latter is covered with hard and bony plates, in their large scales, and in the flat rays of their branchiæ; but there are twelve of these rays. Between the branches of their lower jaw is a sort of osseous buckler, the rudiment of which is visible in Megalops and Elops; behind their conical teeth are others resembling small paving-stones, and their dorsal, which commences between the pectorals and ventrals, extends closely to the caudal. The anal, on the contrary, is short. Each nostril is provided with a little tubular appendage. The stomach is ample and fleshy, the intestine wide, strong, and without cæca, and, what is very remarkable, the natatory bladder is cellular, like the lung of a reptile.

A. calva, L.; Bl., Schn. 80†. The only species known; it is found in the rivers of Carolina, where it feeds on crabs. It is rarely eaten.

SUDIS†, *Cuv.*

The Vastrès are also fresh-water fishes, which have all the characters of an Erythrinus, except that their dorsal and anal, placed opposite to each other, and of about an equal size, occupy the last third of the total length of the body.

There is one species with a very short snout, *Sudis Adansonii*, Cuv., brought from the Senegal by Adanson, and which was also found in the Nile by M. Ruppel; and another, *S. gigas*, Cuv., *S. pirarucu* Spix, XVI, of a very great size, with an oblong snout, large bony scales, and singularly rough head, from Brazil. A third, *S. niloticus*, Ehr., discovered by M. Ehrenberg in the Nile, has a singular spinal tube, which adheres to the third branchiæ, perhaps some-

* *Esox malabaricus*, Bl. 392;—*Synodus erythrinus*, Bl., Schn. Gron., Mus. VII, vi;—*Syn. tareira*, Bl., Schn., pl. 79, Marcgr. 157; *Syn. palustris*, Bl., Schn., *maturaque*, Marcgr. 169;—*Erythrinus taeniatus*, Spix, XIX; probably also the *Esox gymnocephalus*, L.

N. B. The *Synodus vulpes*, only known from Catesby, II, xxx, which appears to me to be the same as the *But. banane*, and as the *Synodus synodus*, Schn., only known by a fig. of Gronovius, Zooph., and Mus. VIII, 2, is a *Salmo saurus*, which had lost its second dorsal. The *Esox synodus*, L., so far as we can judge from the short description, is different.

† N. B. The *Amia immaculata*, Schn. 451, or the *Macabi*, Parra, XXXV, 1, 3, 5, is nothing more than the *Butirin banane*.

‡ *Sudis*, a name employed by Pliny as synonymous with *Sphyræna*.

what analogous to that observed in *Anabas* and other neighbouring genera. The

OSTEOGLOSSUM, *Vandelli*,

Have many points of resemblance with *Sudis*, but are particularly distinguished from that genus by two cirri, which float from beneath the symphysis of the lower jaw; the anal is united with the caudal; the tongue is bony and excessively rough, from the circumstance of its being so completely covered with short, straight, and truncated teeth, that it serves as a grater for reducing fruits into pulp, or for expressing their juice.

O. Vandelli, Cuv.; *Ischnosoma bicirrhosum*, Spix, XXV. A tolerably large species from Brazil.

LEPISOSTEUS, *Lacép.*,

Have the snout formed by the union of the intermaxillaries and maxillaries with the palatines to the vomer and ethmoid; the lower jaw equal in length, and the edges of both of them, their whole interior surface being covered with rasp-like teeth, provided with a series of long-pointed teeth. The branchiæ are united on the throat by a common membrane which has three rays on each side. The scales are of a stony hardness, and the dorsal and anal opposite to each other and very far back. The two last rays of the tail-fin, and the first of all the others, are invested with scales, which give them the appearance of being dentated. The stomach is continuous with a thin intestine, which is twice flexed, and provided with numerous short cæca at the pylorus; the natatory bladder is cellular as in the *Amiæ*, and occupies the whole length of the abdomen.

They inhabit the lakes and rivers of the hot climates of America*, attain a large size, and form an agreeable food†.

POLYPTERUS, *Geoff.*

The Bichirs have the margins of the upper jaw immoveable, the middle formed by the intermaxillaries, and the sides by the maxillaries; a shagreened bony plate, like those on the rest of the head, covers the whole cheek, and there is but a single flat ray in the branchiæ. The elongated body is invested with stony scales as in *Lepisosteus*, and what particularly distinguishes this genus from all others is a great number of separate fins extending along the back, each of which is upheld by a strong spine, furnished with some soft rays, attached to its posterior edge. The caudal surrounds the end of the tail, the anal is close to it, the ventrals are very far back, and the pectorals placed on a scaly and somewhat elongated arm. There is a range of conical teeth round each jaw, and behind them others which are small and crowded, or rasp-like. The stomach is

* I do not believe with Bloch that the fish from the East Indies, Renard VIII, f. 56; Valent. III, 459, is the *Esox osseus*—it is more probably a species of *Belone*.

† The Caïman, *Esox osseus*, L., Bl. 390;—the *Lepisostée spatule*, Lacép. V, vi, 2, and the other species or varieties described by Rafin., Fishes of the Ohio, p. 72, et seq.

N. B. Under the name of *Esox viridis*, Linnæus appears to have united a description of the *Belone* sent by Garden with the figure of the Caïman given by Catesby, II, xxx.

very large, the intestines thin, straight, and furnished with a spiral valve and a single cæcum; the double natatory bladder has large lobes, that on the left is particularly so, and communicates with the œsophagus by a wide hole.

There is one species with sixteen dorsals, discovered in the Nile by M. Geoffroy, *Polypterus bichir*, Geoff., Ann. Mus. I, v; and another from the Senegal which has but twelve, the *P. senegalus*, Cuv. Their flesh is excellent.

ORDER III.

SUBBRACHIAN (a) MALACOPTERYGIANS.

THIS order is characterized by ventrals inserted under the pectorals; the pelvis is also directly suspended to the bones of the shoulder. It contains almost as many families as it does genera.

FAMILY I.


GADITES.

This family is almost wholly composed of the great genus

GADUS*, *Lin.*,

The Cod-fish, recognized by the ventrals, which are pointed and attached to the throat. The body is moderately elongated, slightly compressed, and covered with soft and very numerous scales; the head is well proportioned, but without scales; all the fins are soft; the jaws and front of the vomer armed with pointed, unequal, moderate, or small teeth, disposed in several rows, and resembling a card or rasp; the branchiæ are large and have seven rays. Nearly the whole of the genus have two or three fins on the back, one or two behind the anus, and a distinct caudal. The

* *Gadus* is in Athens the Greek name of a fish also called *Onos*. Artedi applied it to this genus in order to avoid those of *Onos*, *Assellus*, and *Mustela*, employed by the antients, and which were thought, by the first modern ichthyologists, though without proof, to indicate some of our Gadi, but which, being also names of quadrupeds, would have occasioned ambiguity.

 (a) The word *Subbrachian*, which means under the arm, is used in reference to the peculiar arrangement of the ventral fins under the pectorals. The latter fins are considered by Cuvier as analogous to the arms of man, and hence he uses this term.—ENG. ED.

stomach forms a strong and large sac, the cæca are very numerous, and the intestine is long. The natatory bladder is large, with strong parietes, and frequently dentated on the sides.

The greater number of these fishes inhabit cold or temperate seas, and constitute the object of important fisheries (a). Their white flesh, easily separated in layers, is generally esteemed as light, wholesome, and sapid. They may be subdivided as follows:—

MORRHUA, Cuv.

Three dorsal fins and two anals; a cirrus at the point of the lower jaw; they are very numerous.

Gadus morrhua, L., Bl. 64*. (The true *Morue* or *Cabeliau*. The Cod). From two to three feet long; back spotted with yellowish and brown; it inhabits the whole Northern Ocean, and multiplies so excessively (b) in north latitudes, that whole fleets are annually dispatched to capture it. The fresh Cod is termed in France *Cabeliau*, from its Dutch name.

Gadus æglefinus, L.; Bl. 62. (The Egrefin. The Haddock). The back brown, belly silvery, and lateral line black; a blackish spot behind the pectoral: quite as numerous in northern latitudes as the cod, but not so agreeable in taste†. When salted, it is here called Hadon, from its English name Haddock.

Gadus callarias, L.; Bl. 63‡; the *Faux Merlan* of the Paris market. (The Dorse). Spotted like the Cod, but generally much smaller, and the upper jaw longer than the other. The best of the genus when eaten fresh, and in great request on the coast of the Baltic§.

* Bélon is of opinion that *morrhue* is derived from *merwel*, a name which he says is English; it is not to be found, however, among the modern authors of that nation—they call it Cod or Cod-fish.

† *Egrefin*, or rather *Eaglefin*, according to Bélon and Rondelet, was its antient English name. It is the *Schelfisch* of Anderson, the Germans, Dutch, Danes, &c.

‡ *Dorsch*, the name of this fish on the coast of the Baltic. *Callarias*, *Galaras*, &c., were undetermined antient names which were certainly not applicable to a fish foreign to the Mediterranean.

§ Add, the *Tomcod* (*G. tomcodus*, Mitch.);—the *Tacaud*, *Gode*, *Mollet* (*G. barbatus*, Bl. 166);—the *Capelan* (*G. minutus*, Bl. 67, 1);—the *Wachnia* (*G. macrocephalus*, Tiles.) Act of Petersb. II, pl. xvi;—*Gadus gracilis*, Id. Ib., pl. xviii;—the *Saida* (*Gad. saida*, Lepechin), Nov. Com., Petrop. XVIII, p. v, f. 1, copied Encyclop., f. 360;—the *Bib* (*Gad. luscus*, Penn.), cop. Encyc. 102;—*Gad. blennoides*, Penn., copied Encyclop. 363.

☞ (a) The great Sand-bank of Newfoundland is the most famous of the Cod-fisheries in the world, and is resorted to by our fishermen every season for this fish. It is taken with the hook, and it is said to have resorted to this locality in consequence of the greatest quantities of its food, muscles and clams being found.—ENG. ED.

☞ (b) The Cod produces the most of the whole class of fishes; nearly four millions of ova (each of which becomes a cod) are spawned by each of these fishes.—ENG. ED.

MERLANGUS, *Cuv.*

The Merlans, in which there are the same number of fins as the Cod, but no cirri.

Gadus merlangus, L.; Bl. 65. (The Whiting). Well known along the sea-coast for its abundance and the lightness of its flesh; it is distinguished by its pale reddish-grey back and silvery belly, and by the superior length of the upper jaw; the whole fish is about a foot long.

Gad. carbonarius, L.; Bl. 66; *Le Colin*, &c. (The Coal-fish). Twice the size of the Whiting, and of a deep brown colour; the upper jaw shorter; lateral line straight; the flesh of the adult is coriaceous, but it is salted and dried like the Cod* (a).

Gad. pollachius, L.; Bl. 68. (The Pollach). The jaws and nearly the form of the carbonarius; brown above, silvery beneath; flanks spotted. A better fish than the preceding one, and only inferior to the Dorse and Whiting. They all inhabit the Atlantic, and live in large troops †.

MERLUCCIUS, *Cuv.*

But two dorsal fins and a single anal; the cirri deficient as in Merlangus.

Gad. merluccius, L.; Bl. 164. (The Hake). From one to two feet in length, and sometimes much longer; the back brown-grey; anterior dorsal pointed; the lower jaw longest. Great numbers are taken in the Ocean and in the Mediterranean, where the inhabitants of Provence call it the *Merlan*; salted and dried, it receives in the north the name of *Stock-fisch*, which is also applied to the Cod ‡ (b). The

LOTA, *Cuv.*,

To the two dorsals and one anal, adds a greater or less number of cirri.

Gad. molva, L.; Bl. 69 §. (The Ling). From three to four feet in length; olive above, silvery beneath; the two dorsals of an equal height; the lower jaw somewhat shortest, and furnished with a single cirrus. This fish, which is almost as abundant as the Cod, is as easily preserved, and constitutes a fishery of nearly as much importance || (c).

* The common French name *Colin* is taken from its northern appellation of *Kohl-fisch*, or Coal-fish.

† Add, the *Sey*, *Gadus virens*, Ascan. 25.

‡ Add, *Gad. magellanicus*, Forst., App., Bl. Schn. p. 10;—*Gad. miraldi*, Risso, Ed. I, f. 13.

§ *Længa*, *Længe*, *Ling*, names of this fish in various northern countries. *Molva*, a corruption of *morrhua*, applied to this species by Charleton.

|| Add, *Gad. bacchus*, Forst., App., Bl. Schn., p. 53;—*Lota elongata*, Risso, Ed. II, f. 47.

☞ (a) This is the Podley, Sillock, Cuddy, &c., of Scotland.—ENG. ED.

☞ (b) It is also called, with several other dried and salted fishes in this country, Stock-fish.—ENG. ED.

☞ (c) It is prepared in this country almost exclusively for exportation, and is extensively consumed in Ireland in Lent.—ENG. ED.

Gad. lota, L.; Bl. 70. (The Burbot, or River Ling). Length, from one to two feet; yellow, marbled with brown; a single cirrus on the chin; the two fins of equal height; the slightly depressed head and almost cylindrical body give this fish a very peculiar aspect. It is the only one of the genus that ascends rivers to any great distance; its flesh and liver, which latter is very voluminous, are highly esteemed*. Amongst the Ling, we may distinguish,

MOTELLA, Cuv.,

In which the anterior dorsal is so low that it is scarcely perceptible.

Gad. mustela, L.; Bl. 165, under the name of *G. tricirrhatus*. Fawn-coloured brown, with blackish spots; two cirri on the upper jaw, and a third on the lower one†.

BROSMIUS, Cuv.,

Have also no distinct first dorsal, but one single long fin that extends close to the tail.

They are only found in the North. The most common species, *G. brosmе*, Gm., Penn., Brit. Zool. pl. 34, (the Torsk), never descends further than the Orkneys. A larger species, *G. lub.*, New Stockh. Mem. XV, pl. 8, it appears, is taken in Iceland‡.

All these fishes are salted and dried.

BROTULA, Cuv.

The dorsal and anal united with the caudal, forming one fin, terminating in a point.

But a single species is known, the *Enchelyopus barbatus*, with six cirri, Bl. Schn.; Parra, pl. xxxi, f. 2 §. From the Antilles. The

PHYCIS||, Artéd. and Schn.,

Only differ from the other Cods in having ventrals with a single ray, and frequently forked. Independently of this, the head is thick, the chin furnished with a cirrus, and the back with two fins; the second of which is long. Some species are found in the seas of Europe.

P. mediterraneus, Laroche; *P. tinca*, Schn.; *Blennius phycis*,

* Add, *Gadus maculosus*, Lesueur, Ac. Nat. Sc. Philad. I, p. 83.

† Add, *Gad. cimbrius*, Schn., pl. 9; or *G. quinquecirrhatus*, Penn., Brit. Zool. pl. 33, improperly called *Mustela* by Bloch and Gmelin. Compare, also, the *Mustela maculata* and *fusca*, Risso, Ed. II, p. 215, and the *Blennius lupus* and *labrus*, Rafin., Caratt., pl. iii, f. 2 and 3.

‡ The names of *Ling* and *Dorse* are also applied to the Torsks (*Bromus*) in several Cantons. See Penn., loc. cit., and Olafsen. Voy. en Isl., tr. fr. pl. 27 and 28.

§ My four subdivisions, *LOTA*, *MOTELLA*, *BROSMIUS*, and *BROTULA*, are united by Schneider in the genus *ENCHELYOPUS*. This name, originally formed by Klein for all sorts of elongated fishes, signifies *anguilliform*. Gronovius restricted it to the *Blennius viviparus*, which is my genus *ZOARCUS*.

|| *Phycis*, the old name of a Goby. Rondelet applied it to our first species, of which Artedi had made a genus, united with the Blennies by Linnæus, and re-established by Bloch, Ed. Schn. p. 56.

L.; Salvian., fol. 230. (The Sea-Tench). The most common in the Mediterranean; its anterior dorsal is round, and not higher than the other; ventrals about the length of the head.

P. blennoides, Schn.; *Gad. albidus*, Gm.; *Blennius gadoides*, Riss.; *Gad. furcatus*, Penn.; *Merlus barbu*, Duham. II, pl. xxv, f. 4. (The Forked Hake). Another species that is also taken in the Ocean; the first dorsal is more elevated, and its first ray considerably elongated; ventrals twice the length of its head*.

RANICEPS, Cuv.,

Have the head more depressed than that of a *Phycis* or of any other Cod, and the anterior dorsal so extremely small, that it is lost, as it were, in the thickness of the skin. From the Ocean†.

It is impossible to avoid approximating to the *Gadi* the following genus,

MACROURUS, Bl.—LEPIDOLEPRUS, Risso.

Their suborbitals unite in front with each other, and with the bones of the nose, to form a depressed snout, which projects above the mouth, and beneath which the latter preserves its mobility. The entire head and body are invested with hard scales covered with small spines; ventrals small and somewhat jugular; pectorals moderate; first dorsal short and high; the second dorsal and the anal both very long, uniting in a point at the caudal; only very fine and very short teeth in the jaws. They inhabit deep water, and when taken from it utter sounds similar to those produced by a *Gristes*.

Two species are captured in the depths of the Ocean and the Mediterranean, the *Lepidol. cælorhynchus* and *trachyrhynchus* of Risso, Ed. I, pl. vii, f. 21 and 22‡.

* The above characters were taken down by me with both the fishes under my eye. The *Batrachoides Gmelini*, Riss., Ed. I, fig. 16, does not differ from our first species. Add the *Enchelyopus americanus*, Schn., or *Blennius chubs*, Nat. of Berl. VII, 143, or *Gadus longipes*, Mitch. I, 4. N. B. The fig. of Schn., pl. vi, is improperly referred to the *Phycis tinca*, as has been truly remarked by M. de la Roche, Ann. Mus. XIII, p. 333; it is rather that of the *G. longipes*.

† The *Gadus raninus*, Mull. Zool. Dan., pl. 45. *Blennius raninus*, Gmel. *Batrachoides blennioides*, Lacép. *Phycis ranina*, Bl. Schn. 57;—the *Gadus trifurcatus*, Penn., Brit. Zool. III, pl. 32. *Phycis fusca*, Schn.

‡ Direct comparison has satisfied me that the *Lepidoleprus cælorhynchus* of the Mediterranean, Risso, Ed. I, pl. vii, f. 22, does not differ in the least from the *Macrourus rupestris*, Bl. 177, or *Coryphæna rupestris*, Gmel., Gunner, Mem. de Dronth. III, pl. iii, f. 1. On the other hand, the *Lepidoleprus trachyrhynchus*, Risso, Ib., f. 21, is the same fish as the *Oxycephas scabrus*, Rafin., Indic. pl. 1, f. 2. The same species, or one closely allied to it, is given in the Atlas of Krusenst., pl. lx, f. 8 and 9. Giorna had also furnished incomplete figures of the two species, Mem. of the Ac. of Turin, Vol. IX, pl. 1. The *Lepidoleprus trachyrhynchus* is also the *Mysticetus* of Aldrovand. Pisc. p. 342.

The second family of Subbrachian Malacopterygians, commonly called,

FAMILY II.

FLAT-FISHES,

Comprises the great genus

PLEURONECTES*, *Lin.*

These fishes present a character which is perfectly unique amongst vertebrated animals: it is the total want of symmetry in the head, where both eyes are on one side, which always remains uppermost when the animal is swimming; and which is always deeply coloured, while that on which the eyes are wanting is always whitish. The remainder of the body, although, generally speaking, formed as usual, participates a little in this irregularity. Thus the two sides of the mouth are not equal, and the two pectorals are rarely so. Their body is strongly compressed and vertically elevated; the dorsal extends along the whole back; the anal occupies the under part of the body, and almost seems to be continued forwards by the ventrals, which are frequently united with it. There are six rays in the branchiæ. The abdominal cavity is small, but is prolonged by a sinus, which penetrates into the thickness of both sides of the tail, for the purpose of lodging a portion of the viscera. The natatory bladder is wanting, and they seldom quit the bottom. The cranium is rendered an object of curiosity by this subversion, which throws both orbits on one side; all the bones, however, common to other genera, are found in it, but unequally proportioned. They are taken along the coasts of almost all countries, and furnish a wholesome and delicious article of food.

Individuals are sometimes captured whose eyes are placed on the side opposite to that in which they are generally seen, they are then said to be *contournés*, or turned; others, again, have both sides of the body coloured alike, when they are called *doubles* or doubled; it is most generally the brown side which is thus reproduced, though it sometimes happens to the white one†. We divide them as follows:

PLATESSA, *Cuv.*,

The Plaices have a range of obtuse trenchant teeth in each jaw, and, generally, teeth as if paved in the pharyngeals; the dorsal extending no farther than to above the upper eye, and leaving, as does the anal, a naked interval between it and the caudal. The form of these fishes is rhomboidal, and most of them have their eyes on the right; they have two or three small cæca. Several species are found in the seas of Europe, such as,

* *Pleuronectes*, a name formed by Artedi, from *pleura*, the flank, and *nektes*, a swimmer, because they swim on the side. The antients gave them different names according to the species, such as *Passer*, *Rhombus*, *Buglossa*, &c.

† The *Rose-coloured Flounder*, Shaw, IV, ii, pl. 43, is one of those in which the white side is doubled.

P. platessa, Cuv.; Bl. 42; *Pleuronectes platessa*, L.; the *Carrelet*(*a*) of the French. (The Plaice). Easily recognized by six or seven tubercles, forming a line on the straight side of its head, between the eyes, and by the pale yellow spots which relieve the brown on the same side of the body. Its height is but one-third of its length. Its flesh is considered more tender than that of any of this subgenus*.

P. latus, Cuv. (The Broad Plaice). Has the same tubercles as the preceding, but the body is only once and a half as long as it is high. It is sometimes taken on the coast of France, though rarely.

P. flesus, L.; Bl. 44, and 50, under the name of *Pl. passer*†. (The Flounder). Nearly similar in form to the *platessa*, but with lighter spots; more granules on the salient line of the head; a small rough button on the base of each ray along the whole of the dorsal and anal; lateral line covered with roughened scales. This species ascends rivers to a great distance, and individuals are frequently found *turned*.

P. pola, Cuv.; *Vraie Limandelle*, Duham. Sect. IX, pl. vi, f. 3 and 4. The form oblong and approaching that of the Sole, although wider, and distinguished from other Plaice with trenchant teeth, by a smaller head and mouth; body smooth, and lateral line straight. It is considered in France equal to the Sole.

P. limanda, L.; Bl. 46. (The Dab). Form rhomboidal, like that of the Flounder; eyes large, with a salient line between them; the lateral line strongly curved above the pectoral; scales rougher than those of the preceding, whence its French name *Limande*, (from *lima*, file); the teeth on a single range as in other Plaice, but narrower and almost linear; the side on which the eyes are placed is of a light brown, with some faded brown and whitish spots‡.

HIPPOGLOSSUS, Cuv.,

Have the shape and fins of a Plaice, with the jaws and pharynx armed with teeth, which are most commonly strong and pointed; the form is usually more oblong.

P. hippoglossus, L.; Bl. 47. (The Holibut). Eyes on the right side; lateral line arcuated above the pectoral. From the North Seas, where it attains a length of six or seven feet, and weighs from three

(a) N. B. The name of *Carrelet* or *petit Carreau* has been applied by some authors to the *P. rhombus*, but contrary to the custom of our sea-ports and markets. The true *Carrelet* is a young Plaice.

* It would appear that there is a very large Plaice found in the North, which, in some respects, differs from that taken on the coast of France, and chiefly in the spine, which, behind the anus, lies buried under the skin—it is the *Pl. borealis*, Faber, Isis, tom. XXI, p. 868.

† The *Pl. passer* of Artedi and Linnæus does not differ from the Turbot; that of Bloch is only an old Flounder turned to the left.

‡ Add, *Pleur. planus*, Mitch.;—*Pleur. stellatus*, Pall., Mem. Ac. Petersb. III, x, 1.

to four hundred pounds. It is salted, dried, and sold in slices throughout the whole of the North*.

The Mediterranean produces several smaller species, some of which have the eyes on the left; one of them is the

P. macrolepidotus, Bl. 190; *Citharus*, Rondel. 314. Oblong; lateral line straight; distinguished by the scales, which are larger in proportion than in any other.

RHOMBUS, Cuv.

The Turbots have the teeth small and crowded, or like those of a card, in the jaws and pharynx, as in *Hippoglossus*; but the dorsal advances towards the edge of the upper jaw, and extends, as well as the anal, close to the caudal. The eyes of most of them are on the left side.

In some the eyes are approximated, the interval being occupied by a slightly salient crest. Such are the two following large species of the coast of Europe, the most highly esteemed of the whole genus.

Pl. maximus, L.; Bl. 49. (The Turbot). The body rhomboidal and almost as high as it is long, the brown side studded with small tubercles.

Pl. rhombus, L.; Bl. 43; *la Barbue*; the body more oval and without tubercles; distinguished by the first rays of the dorsal, which are half free, and split into thongs at the extremity.

Pl. punctatus, Bl. 189; *Pl. lævis*, Shaw; *Pl. hirtus*, Dan. Zool. pl. 103; the *Kitt* of the English, Penn., pl. 41; Ray, Syn. pl. 1, f. 1; Duham., Sect. IX, pl. v, f. 4. Much less common on the coast of Europe; oval like the *Barbue*, but has no thongs to its rays; scales rough; teeth very small; the cheek covered as if with fine velvet; black spots and points on a brown ground †.

Pl. cardina, Cuv.; Duham. Sect. IX, pl. vi, f. 5; and Ray, 170, pl. 1, No. 2 ‡; *La Cardine*, or *Calimande*. (The Whiff). Perfectly oblong; its first rays free, but simple; teeth very short, small, and dense as the pile on velvet; white and blackish spots, partly laid on a brown ground. It is sometimes, though rarely, taken on the coast of the British Channel.

Pl. nudus, Risso; *Arnoglossum*, Rondel. 324. A Mediterranean

* The *Pl. limandoides*, Bl. 186, or *Citharus asper*, Rondel., 315, and the *punguis*, Faber, Isis, tom. XXI, p. 870, also appear to be northern *Hippoglossi*. Add, *Pleur. erumei*, Bl. Schn., or *Adalah*, Russel, I, 69;—*Pl. nalaka*, Cuv., or *Norée nalaka*, Russel, 77.

† I have reason to believe that the *Pl. unimaculatus*, Risso, Ed. II, f. 35, is merely a sexual variety of the *punctatus*.

‡ These figures represent the eyes on the right, whereas they are on the left. Bloch, by some strange aberration, thought that the *Whiff* of Ray and Pennant was the *lævis*, but the *lævis* is the *Kitt* of those authors—a single glance at the first plate of Ray, where they are both figured, will convince any one of the fact. Add, *Pl. triocellatus*, Schn., Russ. 76;—*Pl. maculosus*, Cuv., Russ. 75;—*Pl. aquosus*, Mitch. pl. ii, f. 3;—*Pl. Boscii*, Riss. Ed. I, pl. viii, f. 33;—*Pl. aramaca*, Cuv., Maregr. 181, very different from the *Pl. macrolepidotus*, which is not from Brazil, but from the Mediterranean, and with which Bloch has confounded it.

species but a few inches long, whose large thin scales are easily dislodged. The same sea produces another, the

R. candidissimus, Risso, Ed. II, f. 34; *Pl. diaphanus*, Schn. IV, part ii, 309. Still smaller, wholly diaphanous, with a series of separated red spots on the dorsal and anal.

In others the eyes are far apart, and the upper one is thrown backwards, the interval between them being concave. At the base of the maxillary, on the side on which the eyes are placed, is a small salient hook, and sometimes a second one is found over the lower eye. Species of this description are taken in the Mediterranean*.

SOLEA, Cuv.

The Soles have, as their peculiar characteristic, the mouth twisted to the side opposite to the eyes, and on that side only furnished with very minute and crowded teeth, the opposite one being edentated. The form is oblong; snout rounded, and generally projecting beyond the mouth; the dorsal commencing at the mouth, and extending, as well as the anal, to the caudal; lateral line straight; side of the head opposite to the eyes usually covered with a sort of villosity. The intestine is long and has several flexures, but no cæca.

Pl. solea, L.; Bl. 45. (The Sole). A well-known and common species; brown on the side in which the eyes are placed; pectorals spotted with black, &c.—one of the best fishes.

There are several other species, particularly in the Mediterranean†.

In some foreign species there is no distinction between the three vertical fins‡.

MONOCHIRUS, Cuv.

One extremely small pectoral on the side with the eye, the opposite one almost imperceptible or totally wanting.

Pleur. microchirus, Laroche, Ann. Mus. XIII, 356; *Linguatula*, Rondel. 324. A Mediterranean species§.

* *Pleur. podas*, Laroche, Ann. du Mus. XIII, xxiv, 14, or *Pl. rhomboïdes*, Rondel. 313, which is also the same as the *Pl. argus* and *mancus* of Risso, Ed. I.; *Pleur. mancus*, Brousson. Dec. Ichth. pl. iii, iv;—*Pl. argus*, Bl., and *lunatus*, Gm., Bl. 48, or better, Catesb., Carol. XXVII.

† The *Pole* of Bélon, 143, and of Rondel. 323, different from the one sold at Paris, which is a *Plaice*, according to these authors, has the eyes on the left; I am not sure it is the *Rh. polus*, Riss. Ed. II, f. 32, in which the eyes are on the right;—the *Pl. ocellatus*, Sch. 40, the same as the *Pl. Rondeletii*, Sh., *Solea oculata*, or *Pégouze*, Rondel., 322;—*Pl. lascaris*, Risso, Ed. I, pl. vii, f. 32, and other foreign species to be described in our Hist. des Poissons.

‡ *Pl. zebra*, Bl. 187;—*Bl. plagiusa*, L.;—*Pl. orientalis*, Schn. 157;—*Pl. Commersonien*, Lac. III, xii, 2. or *Jerré potoo*, A, Russel, 70; but the description, Lacép. IV, 656, belongs to another species of the subgenus *Rhombus*;—the *Horned-sole*, Russ. 72, an incorrect figure;—*Pl. jerveus*, Cuv., or *Jerre potoo*, B, Russel, 71;—*Pl. pan*, Buch. XIV, 42.

§ It is probably the *Pleur. mangilii*, Risso, 310. Other species exist, some of which are unquestionably confounded with the *Achiri* of authors. The *Pl. trichodactylus* must also belong to this subgenus. Add, the *pegouze* of Risso, 308, Ed. II, f. 33;—*Mon. théophile*, Id.

ACHIRUS, *Lacép.*

Soles totally deprived of pectoral fins.

They may also be divided into ACHIRUS properly so called*, in which the vertical fins are distinct; and into PLAGUSIA, Brown†, in which they are united with the caudal.

The third family, which we shall call,

FAMILY III.

DISCOBOLI,

On account of the disk formed by their ventrals, comprehend two small genera.

LEPADOGASTER, *Gouan.*

They are small fishes, remarkable for the following characters: their ample pectorals, having reached the inferior surface of the trunk, assume stouter rays, curve slightly forwards, and unite with each other on the throat by a transverse membrane directed forwards, which is formed by the union of the ventrals. The body is smooth and without scales, the head broad and depressed, the snout salient and protractile; the branchiæ, but slightly cleft, are furnished with four or five rays, and they have but a single soft dorsal opposite to a similar anal. The intestine is short, straight, and without cæca, and notwithstanding they are deprived of a natatory bladder, they may be seen swimming along the shores with great vivacity. In

LEPADOGASTER, *properly so called,*

The membrane which represents the ventrals extends circularly under the pelvis, and forms a concave disk; on the other side the bones of the shoulder project slightly behind, which completes a second disk by means of the membrane which unites the pectorals. Several species inhabit the seas of Europe.

In some, the dorsal and anal are separated from the caudal, with which, however, their membrane is sometimes continuous, but becomes narrower‡.

In others, the three fins are united§. In the

* *Pl. achirus*, L., *Achire barbu*, Geoff. Ann. du Mus. vol. I, pl. xi. It is not the same as that of Lacép. It is necessary to observe that its barbs are not rays, but cilia, such as are found in the common Sole, and on many of the Achiri;—the *Ach. marbré*, Lac. III, xii, 3, and IV, p. 660;—the *Ach. fascé*, Id., *Pl. lineatus*, Sloane, Jam., pl. 346;—*Pl. mollis*, Mitch. II, 4.

† *Pl. bilineatus*, Bl. 188, or *Jerré potoo*, E, Russel, 74;—the *Ach. orné*, Lacép. IV, p. 663;—*Pleur. arel*, Sch. 159, *Pl. plagusia*, aff., Jam., Br. 445, different from the *Pl. plagiusa*, L.;—*Pl. potous*, Cuv., or *Jerré potoo*, D, Russel, 73.

‡ *Lepadog. gouan*, Lacép. I, xxiii, 3, 4, or *Lep. rostratus*, Schn.;—*Lep. balbis*, Risso, pl. iv, f. 9, probably the same as the *Cyclopt. cornubicus*, Sh., Cornish Sucker, or *Jura sucker*, Penn. Brit Zool., No. 59;—*Lep. Decandolle*, Risso, p. 76.

§ *Lepadogaster Wildenow*, Risso, p. 76.

GOBIESOCES, *Lacép.*,

There are none of these double borders, and consequently the interval between the pectorals and ventrals is not divided into a double disk, forming but a single large one cleft on the two sides, and extending itself there by membranes. The dorsal and anal are short and separate from the caudal, and the branchial openings much larger*.

CYCLOPTERUS, *Lin.*

The Suckers have a well-marked character in their ventrals, the rays of which suspended round the pelvis, and united by a single membrane, form an oval and concave disk, used by the fish as a sucker to attach itself to rocks. The mouth is wide, and its jaws and pharyngeals furnished with small and pointed teeth; opercula small; branchiæ closed below, and provided with six rays; pectorals very large, and uniting almost beneath the throat, as if to embrace the disk of the ventrals. The skeleton hardens but little, and the skin is viscous, without scales, but studded with indurated granules. There is a large stomach with numerous cæca, a long intestine and a moderate natatory bladder. We divide them into two subgenera.

LUMPUS, *Cuv.*

The first dorsal more or less visible, although very low, and with simple rays; a second with branched rays opposite to the anal; the body is thicker.

Cyclopterus lumpus, L.; Bl. 90; *Le gras Mollet*. (The Lump Sucker) (a). The first dorsal so enveloped in a thick and tubercular skin, that one would take it for a mere hump on the back; there are three ranges of thick conical tubercles on each side of it. It feeds on Medusæ and other gelatinous animals, particularly in the North. Its flesh is soft and insipid; heavy, and with scarcely any means of defence, it becomes the prey of the Seal, Shark, &c. The male is said to keep careful watch over the fecundated eggs†.

LIPARIS, *Artéd.*

A single dorsal, which, as well as the anal, is rather long; the body smooth, elongated, and compressed behind.

* *Lepadogaster dentex*, Schn., Pall. Spic. VIII, 1, the same as the *Cyclopterus nudus*, Lin., Mus. Ad. Fred. XXVII, 1, and as the *Gobiësoce testar*, Lacép, II, xix, 1;—*Cyclopterus bimaculatus*, Penn., Brit. Zool. pl. xxii, f. 1;—*Cyclopterus littoreus*, Schn. 199.

† The *Cyclopterus pavonius* is a mere variety of age of the *lumpus*. The *Cyclop. gibbosus*, Will. V, 10, f. 2, appears to be the *vulgaris* badly stuffed. Add, the *Cyclop. spinosus*, Schn. 46;—*Cyclop. minutus*, (the Small Sucker), Pall., Spic. VII, iii, 7, 8, 9;—*Cyclop. ventricosus*, Id., Ib. II, 1, 2, 3?—*Gobius minutus*, Dan. Zool. CLIV, B.

(a) Pennant tells us that the sucker in this fish is so strong, that, when put into a tub of water, it adhered so firmly to the bottom, that when it was lifted by the tail the tub was raised with it.—ENG. ED.

Cycl. liparis, L.; Bl. 123, 3, 4. Inhabits the coast of France*.

The genus, of which we are about to speak, may, like the Pleuronectes, be constructed into a particular family of Subbrachian Malacopterygians.

ECHENEIS(a), *Lin.*,


Are remarkable, above all fishes, for a flattened disk placed upon their head, composed of a certain number of transverse, cartilaginous laminae, directed obliquely backwards, dentated or spiny on their posterior edge, and moveable, so that by creating a vacuum between them, or by hooking on to various bodies, such as rocks, ships, fishes, &c., by means of the spines, they are enabled to attach themselves firmly thereto, a circumstance which gave rise to the fabulous saying, that the Remora possessed the power of suddenly stopping a vessel in the middle of its swiftest course.

Their body is elongated and covered with small scales; there is a small soft dorsal opposite to the anal; the top of the head is perfectly flat; the eyes are on the side; the mouth cleft horizontally and rounded; the lower jaw projects beyond the other, and is furnished, as are the intermaxillaries, with small teeth resembling those of a card; a very regular range of delicate teeth, that may be compared to cilia, runs along the edge of the maxillaries, which form the external border of the upper jaw; the anterior edge of the vomer is furnished with a band of teeth like those of a card, and its whole surface, which is wide, as well as the tongue, is very rough. They have eight branchiostegal rays; their stomach is a wide cul-de-sac; they have six or eight cæca, but no natatory bladder; their intestine is ample but short.

The species are not numerous; the most common one that inhabits the Mediterranean, *Echen. remora*, L., Bl. 172, well known by the name of *Remora*, is the shortest, and has but eighteen laminae in its disk. Another and longer species, *Ech. naucratus*, L., (the Indian Remora), Bl. 171, has twenty-two; and the third, the longest of all, *Ech. lineata*, Schn., Linn. Trans. pl. 17, has but ten.

We have discovered a species, *Ech. osteochir*, Cuv., whose pectoral rays are osseous, compressed, and terminated by a slightly crenated palette.

* It is the same as the *Gobioide smyrnæen*, Lacep., Nov. Com. Petrop. IX, pl. ix, f. 4 and 6, and probably as the *Cyclop. souris*, Lacép. IV, xv, 3, and perhaps as the pretended *Gobius*, Dan. Zool. CXXXIV;—Add, *Cyclop. montagui*, Wern. Soc. I, v, 1;—*Cyclop. gelatinosus*, Pall., Spic. VII, iii, 1;—*Gobius*, Dan. Zool. CLIV, A.

 (a) *Echeneis* is a Latin word used by Pliny for a small fish, that, sticking to the keel of a ship, was supposed to stop its course. The Romans attributed to this animal the loss of the great battle of Actium by Anthony, whose ship it delayed. Lucan's line, in reference to the event, is,

“Puppim retinet in mediis echeneis aquis.”—ENG. ED.

The fourth Order of Fishes is that of

ORDER IV.

APODAL MALACOPTERYGIANS.

THIS order may be considered as forming but a single natural family, that of the

ANGUILLIFORMES.

Fishes with an elongated form, a thick and soft skin, which almost renders its scales invisible, and but few bones. They have no cæca, but nearly all of them possess natatory bladders which frequently assume the most singular shapes. The great genus

MURÆNA, *Lin.*

The Eels are recognized by the little opercula concentrically surrounded by the rays, all of which are enveloped in the skin, which only opens at a considerable distance back by a hole or species of tube, an arrangement which, by more completely protecting the branchiæ, allows these fishes to remain some time out of water without perishing. Their body is long and slender; their scales, as if encrusted in a fat and thick skin, are only distinctly visible after desiccation; they have neither ventrals nor cæca, and their anus is placed far back. This genus has been successively separated into five or six genera, which we are compelled to subdivide still more*.

ANGUILLA, *Thunb. and Shaw.*—MURÆNA, *Bl.*

Eels are distinguished by the two-fold character of pectoral fins and of branchiæ opening under them on each side. Their stomach is a long cul-de-sac; their intestine is nearly straight, and their elongated natatory bladder is furnished near the middle with a peculiar gland.

ANGUILLA, *Cuv.*—MURÆNA, *Lacép.*

The Eels, properly so called, have the dorsal and caudal evidently continued round the end of the tail, forming by their union a pointed caudal.

* In none of these fishes, to our knowledge, are the opercula or rays wanting, as some authors have thought. The common *Muræna* has seven rays on each side; the *Mur. colubrina* has twenty-five. These rays are even very strong in *Synbranchus*, where the operculum is also complete, and formed of all its usual portions.

N.B. The *Echeilos*, Rafin., Nov. Gen., p. 63, pl. xv, 1, 3, pl. xvi, f: 2 and 3, must be of two kinds, the first Eels, and the other Congers, without branchial opercula—but we doubt the truth of this character.

In the TRUE EELS the dorsal commences at a considerable distance behind the pectorals.

In some the upper jaw is the shortest.

The common Eels belong to this division. Our fishermen admit of four kinds, which they pretend constitute as many species, but which are confounded by authors under the name of *Muræna anguilla*, L. (The common Eel); they are the *Ang. verniaux*, which is, I think, the most common; the *Ang. long bec*, whose snout is more pointed and compressed; the *Ang. plat bec*, or the *Grig-eel* of the English, whose snout is more flattened and obtuse, and eyes smaller; and the *Ang. pimper-neaux*, or the *Glut-eel* of the English, where the snout is shorter in proportion, and the eye larger*.

In others the upper jaw is longest†.

In the CONGERS (*Conger*, Cuv.), the dorsal begins very close to the pectorals, or is even upon them; and in all the other species the upper jaw is the longer.

Mur. conger, L.; Bl. 155. (The Conger Eel). Found in all the seas of Europe; it attains the length of five or six feet, and the thickness of a man's leg; dorsal and anal edged with black; lateral line dotted with whitish. It is not in much request for the table, still, when salted, it becomes profitable.

Mur. myrus, L. (The Myre); Rondel. 407‡. From the Mediterranean, with the form of a Conger, but it remains smaller; it is known by spots on the snout, a band across the occiput, and two rows of dots on the nape, all of a whitish colour§.

In some foreign Congers the dorsal commences even before the pectorals, or at least on their base||. The

OPHISURUS, Lacép.

Differ from the true Eels by their dorsal and anal terminating before they reach the end of their tail, which is thus deprived of a fin, and ends like a punch. The posterior orifice of the nostril opens on the very edge of the upper lip. Their intestines are similar to those of an Eel, a portion of them, however, extending into the base of the tail beyond the anus.

The pectoral fins of some are of the ordinary size; their teeth are trenchant and pointed.

* We will give a comparative description of them, with correct figures, in our large Ichthyology.

† *Mur. longicollis*, Cuv.—Lacép. II, iii, 3, under the false name of *Muræna myrus*.

‡ *Myrus*, a fish so called by the antients, which some have considered as the male of the *Muræna*; Rondelet was the first who applied it to this species, which is very distinct, although, since Willoughby, no one has properly described it but Risso; no drawing has been made of it.

§ The Mediterranean produces other small species of Congers described by La-roche and Risso under the names of *Mur. balearica*, Lar., Ann. du Mus. XIII, xx, 3, or *Mur. cassini*, Risso, *Mur. mystax*, Lar., Ib. XXIII, 10;—*Mur. nigra*, Risso, p. 93. The *Mur. strongylodon*, Schn. 91, which is far from being a variety of *myrus*, as that author supposes, should also be referred to them.—The *Anguillée marbrée*, Quoy and Gaym., Zool. Voy. de Freycin., pl. 51, f. 2.

|| *Mur. talabou*, Russel, 38;—*Mur. savanna*, Cuv., from Martinique;—the *C. à chapelet*, Krusenst. V, lx, 7.

Mur. serpens, L.; Salv. 57. (The Snake Eel). From five to six feet and upwards in length, and of the thickness of a man's arm; brown above, silvery beneath; the snout slender and pointed; twenty rays in the branchial membrane. From the Mediterranean*.

In others the pectorals are so extremely small, as sometimes to have escaped the notice of observers. They connect the Eels with the *Muræna*: their teeth are obtuse†.

MURÆNA, Thunb.—*GYMNOTHORAX*, Bl.—*MURÆNOPHIS*, Lacép.

The *Muræna*, properly so called, have no vestige of pectorals; their branchiæ open on each side by a small hole; their opercula are so thin, and their branchiostegal rays so slender and concealed under the skin, that experienced naturalists have denied their existence. The stomach is a short sac, and the natatory bladder small, oval, and placed near the upper part of the abdomen.

Those species which have a very visible dorsal and anal are the *Murænophis* of Lacépède.

Some of them have a single row of sharp teeth in each jaw. The most celebrated is

M. helenæ. L.; Bl. 153. (The Roman *Muræna*). Common in the Mediterranean; a fish much esteemed by the ancients, who fed it in ponds expressly constructed for that purpose. The history of *Vædinus Pollio*, who caused his transgressing slaves to be flung alive into these ponds as food for the *Murænæ*, is well known (a). It attains a length of three feet and more, is mottled with brown and yellowish, and is excessively voracious‡.

Others have two rows of sharp teeth in each jaw, independently of the one on the vomer§.

In a third kind there are two rows of round or conical teeth in each jaw; such is in the Mediterranean species.

M. Christini, Risso; *M. unicolore*, Laroche, Ann. Mus. XIII, xxv, 15. Everywhere covered with close, small, brown points or lines, which give it the appearance of being uniformly brown||.

* This is doubtless the place of *Mur. ophis*, Bl. 154, *Ophis hyala*, Buchan., pl. v, f. 5;—*Ophis longmuseau*, Quoy et Gaym., Zool. Voy. Freycin., pl. li, f. 1;—*Ophisurus guttatus*, Cuv., a new species from Surinam.

N. B. The *COGRUS*, Rafin., Nov. Gen., p. 62, must be *Ophisuri* without branchial membranes; we fear there is some mistake in this as in his *ECHELUS*.

† *Mur. colubrina*, Bodd., or *annulata*, Thunb., or *Murænophis colubrina*, Lac. V, xix, 1;—*Mur. fasciata*, Thunb.;—*Mur. nob. maculosa*, given under the name of *Ophisurus ophis*, Lacép. II, vi, 2;—the *Oph. atternan*, Quoy et Gaym., Zool. Freycin., pl. 45, f. 2.

‡ Add, the *M. moringa*, Cuv., of the Antilles, Catesb. II, xxi;—*M. punctata*, Bl., Schn.;—*M. meleagris*, Sh., or *M. pintade*, Quoy et Gaym., Voy. Freycin., pl. 52, f. 2;—*M. parthenon*, Id., Ib., f. 2;—*M. savaginea*, Bl., Schn. 105;—*M. pantherine*, Lacép., or *M. picta*, Thunberg.

§ *Murænophis gris*, Lacép. V, xix, 3.

|| The other species are new.

(a) The Romans domesticated these fishes so as to teach them to approach at a call. It is recorded of one of the nobles in ancient Rome, that he went into mourning for a *Muræna* which he had lost.—ENG. ED.

We find some which have a single row of lateral round teeth, and two rows also round on the vomer, the anterior ones conical*.

Another has two rows of lateral round teeth, and four rows, also round, on the vomer, forming a kind of pavement. The fins of this species are scarcely apparent†.

Finally, there are others which have several rows of teeth resembling those of a card; and in the Mediterranean one of these is found, which is

M. saga, Risso, Ed. I, f. 39; *La Sorcière*. Remarkable for its elongated, round, and pointed jaws, and the extension of its tail into a very sharp point‡. The

SPHAGEBRANCHUS, Bl.

Differ from the *Muræna* by their branchial openings reaching each other under the throat. The vertical fins, in several species, only begin to project near the tail; the snout is extended and pointed. The stomach is a long cul-de-sac, the intestine straight, and the bladder long, narrow, and placed behind.

Some species are totally deprived of pectorals§.

Others have small vestiges of them||.

There are even some,—the APTERICHTES, *Dumer.*, CECILIES, *Lacép.*, in which no vertical fin whatever can be perceived, and consequently are Fishes without fins¶.

MONOPTERUS, *Commers. and Lacép.*

This genus has the two branchial apertures united under the throat in a transverse fissure, divided in the middle by a partition; the dorsal and anal only visible in the middle of the tail, and uniting at its point; teeth like those of a card in the jaws and palatines; six rays in each gill, and only three very small branchiæ.

M. javanensis, *Lacép.* The only species known; back green, and a fawn-coloured belly. From the Sunda islands**.

SYNBRANCHUS, Bl.—UNIBRANCHAPERTURE, *Lacép.*

Are distinguished from *Sphagebranchus* by their branchiæ having no external communication, except through the medium of a single opening under the throat; this aperture is round and longitudinal, and is common to both organs. They are destitute of pectoral fins, and their vertical

* *Murenophis étoilé*, *Lacép.*, or *M. nebulosa*, Thunb., Seb. II, lxix, 1;—*M. ondulé*, Lac. V, xix, 2 (*M. catenatus*, Bl., Schn.);—*M. sordida*, Cuv., Seb. II, lxix, 4.

† *Gymnomurène cerclée*, *Lacép.* V, xix, 4, or *M. zebra*, Shaw, Seb. II, lxx, 3.

‡ The *Nettasoma melanura*, Rafin., Caratt., pl. xvi, f. 1, is at least closely allied to this *Saga* of Risso. N. B. The *Dalophis* of Rafinesque, Caratt., pl. vii, f. 2, 3, should be edentated *Murænæ*, but we do not know them.

§ *Sphagebranchus rostratus*, Bl. 419, 2, and the *Leptocephalus Spallanzani*, Risso, 85;—*Cæcula pterygea*, Vahl., Mem. d'Hist. Nat. de Copenh. III, xiii, 1, 2, *Mantibukaro*, aumu, Russel, 1, 37.

|| *Sphagebranchus imberbis*, Laroche, Ann. Mus. XIII, xxv, 18.

¶ *Muræna cæca*, L., Laroche, Ann. Mus. XIII, xxi, 6.

** I suspect it is the same fish figured by *Lacép.* V, xvii, 3, under the different name of *Unibranchaperture lisse*.

ones are almost completely adipose. Their head is thick, their snout rounded, their teeth blunt, their opercula imperfectly cartilaginous; the rays of their gills are strong, and are in number six. Their intestines are all straight, and the only difference between them and the stomach is in the greater size of the latter, and in its being furnished with a pyloric valve. They are without cæca, and their natatory bladder is long and narrow. Their habitats are the seas in warm latitudes. Some of them attain a great size*.

ALABES, *Cuv.*

The Alabes have a common branchial aperture under the throat, as in *Synbranchus*; but the pectorals are well marked, and between them is a little concave disk. A small operculum and three rays are distinguishable through the skin; the teeth pointed, and the intestines as in *synbranchus*.

But a single small species is known; it inhabits the Indian Ocean.

It is immediately after this great genus of the *Muræna* that a newly-discovered fish should be placed; it is one of the most singular that is known;

SACCOPHARYNX, *Mitch.*—OPHIOGNATHUS, *Harwood*,

Whose trunk, susceptible of being so inflated as to resemble a thick tube, terminates in a very long and slender tail, surrounded by an extremely low dorsal and anal, which unite at its point. The mouth, armed with sharp teeth, opens far behind the eyes, which are placed close to the very short point of the snout. The branchial aperture consists in a hole under the pectorals, which are very small.

This fish attains a large size, and appears to be voracious. It has only been seen in the Atlantic Ocean, floating on the surface by the dilatation of its throat†.

GYMNOTUS ‡, *Lin.*

Have, as the Eels, the gills partly closed by a membrane, but opening before the pectorals; the anus very far forwards; the anal fin extends beneath the greater part of the body, and most frequently as far as the end of the tail; but it has no dorsal fin whatever.

GYMNOTUS, *Lacép.*

The Gymnoti also have no fin at the end of the tail, under which the anal one extends.

* *Synbranchus marmoratus*, Bl. 418;—*Synb. immaculatus*, Id. 419, *Unibranch. cachia*. Buchan. XVI, 4, *Dondoo-paum*, Russel, XXXV, has no appearance of a fin.

† The *Saccopharynx flagellum* of Mitchill was six feet in length, and the *Ophiognathus ampullaceus* of Harwood was four and a half. The first appeared to have no teeth in the lower jaw, and it is possible that these two fishes, although found in the same latitude, are different species; they evidently, however, belong to the same genus.

‡ *Gymnotus*, or, properly speaking, *Gymnonotus* (Bare-back), a name given to these fishes by Artedi.

The TRUE GYMNOTI have no sensible scales; their intestines, which have several flexures, occupy but a moderate space; the cæca are numerous, and the stomach resembles a short obtuse sac strongly plaited within. One of their air-vessels, cylindrical and elongated, extends very far behind in a sinus of the abdominal cavity; the other, oval and bilobate, composed of a thick substance, occupies the upper part of the abdomen, and is placed on the œsophagus. The species known inhabit the rivers of South America. The most highly celebrated is

G. electricus, L.; Bl. 156, (The Gymnotus), which, from its almost uniform shape and obtuse head and tail, has also been called the *Electrical Eel*. It is from five to six feet long, and communicates such violent shocks that men and horses are struck down by them. This power is dependent on the will of the animal, which gives it what direction it pleases, and renders it effective, even at a distance, killing fishes therewith, so situated. It is, however, dissipated by use, and to renew it, the Gymnotus requires rest and nourishing food*. The organ which is the seat of this singular faculty extends along the whole under side of the tail, occupying about half its thickness; it is divided into four longitudinal fasciculi, two large ones above, and two smaller ones below, and against the base of the anal fin. Each bundle is composed of numerous parallel, membranous laminæ, nearly horizontal, and closely approximated to each other, one end terminating on the skin, and the other on the median vertical plane of the animal: they are united with each other by a multiplicity of small transverse and vertical laminæ. The little cells, or rather the little prismatic and transverse canals formed by these two kinds of laminæ, are filled with a gelatinous matter, and the whole apparatus receives a proportionably large number of nerves†.

CARAPUS‡, Cuv.,

Have a compressed and scaly body; the tail much narrowed behind. From the rivers of South America§.

We might, perhaps, distinguish from the common species those with an elongated snout only open at the end||.

STERNARCHUS¶, Schn.—APTERONOTES, Lacép.,

Have the anal terminated before it reaches the end of the tail, which has a fin of its own; a soft fleshy filament on the back, lodged in a groove running to the end of the tail, and retained there by tendinous threads, which still allow it some degree of liberty, a very singular mode of orga-

* See Humboldt, Zool. Obs. I, p. 49, et seq.

† See Hunter, Phil. Trans. Vol. LXV, p. 395. Add, the *Gymnotus æquilabiatus*, Humb. Zool. Obs. I, pl. x, No. 2, according to whose observations this species has no posterior natatory bladder.

‡ *Carapo*, the name of these fishes at Brazil, according to Maregrave.

§ *Gymnotus macrourus*, Bl. 157, 2;—*Carapo*, Gm.;—*G. brachiurus*, Bl. 157, 1;—*fasciatus*, Gm.;—*G. albus*, Seb. III, pl. 32, f. 3.

|| *Gymnotus rostratus*, Schn., pl. 106.

¶ *Sternarchus*, i. e. anus at the sternum.

nization, the use of which cannot be divined*. The head is oblong, compressed, naked, and the skin prevents both the opercula and the rays from being seen externally; rest of the body scaly; teeth small and crowded, and on the middle of each jaw scarcely perceptible. The Sternarchi, like the preceding fishes, inhabit the waters of South America†.

GYMNARCHUS, Cuv.,

Have the body scaly and elongated, and the gills slightly open before the pectorals, as in Gymnotus; but a fin, with soft rays, occupies the whole length of the back; and there is none behind the anus, nor under the tail, which terminates in a point. The head is conical and naked, the mouth small, and furnished with a single row of small trenchant teeth.

G. niloticus, Cuv. The only species known; discovered in the Nile by M. Riffault.

LEPTOCEPHALUS, Pennant.

The members of this genus have the branchial aperture before the pectorals; body compressed like a ribband; head extremely small, with a short and slightly pointed snout; pectorals almost imperceptible, or totally wanting; the dorsal and anal hardly visible, and uniting at the point of the tail. The intestines occupy but an extremely narrow line along the inferior edge. One species only is known,

L. morisii, Gm.; Lacép. II, iii, 2, which inhabits the coasts of France and England. Several other species, however, are found in the seas of hot climates, all of them as thin as paper, and transparent as glass, so that even the skeleton is not visible. The deeper study of their organization is one of the most interesting to which travellers can devote themselves.

OPHIDIUM, Lin.

The Donzelles have the anus, as the Eels, properly so called, far behind; a dorsal and an anal fin united with that of the tail, and terminating the body in a point; this body is besides elongated and compressed, which has led to its being compared to a sword; it is invested, like that of an Eel, with small scales planted in the thickness of the skin. The Donzelles, however, differ from Eels in their well-cleft branchiæ, which are furnished with a very apparent operculum and a membrane with short rays. Their dorsal rays are articulated, but not branched.

OPHIDIUM, Cuv.

The Donzelles, properly so called, have two pairs of small cirri under the throat, adhering to the point of the hyoid bone. There are two of them found in the Mediterranean.

* I think, as far as my observation goes, that the separation is accidental, and that it really is one of the muscles of the tail, which is easily detached in consequence of the skin being more fragile in this particular place.

† *Gymnotus albifrons*, Pall. Spic., Zool. VIII, pl. vi, f. 1; Lacép. II, vi, 146, 3.

N. B. The *Gymnotus acis*, or *fierasfer*, belongs to the genus *Ophidium*, and the *Gymnotus nototernus*, Pall. and Gm., *Notoptère capirat*, Lacep., to the Herrings.

O. barbatum, Bl. 59. (The Common Donzelle). Flesh-coloured; dorsal and anal bordered with black; the anterior cirri shortest; greatest length from eight to ten inches.

O. Vassalli, Risso. (The Common Donzelle). Brown; no edging on the fins; cirri equal. The stomach of these fishes is a thin oblong sac; their intestines, which have several flexures, are without cæca; their oval, large, and very thick natatory bladder is supported by three peculiar bones suspended under the first vertebræ, the middle one of which is moved by its proper muscles. Their flesh is good.

We are acquainted with a third species, which belongs to Brazil; it is,

O. brevibarbe, Cuv. Brown, with shorter cirri.

O. blacodes, Schn. 484*. From the South Seas; a very large rose-coloured species, spotted with brown.

FIERASFER, Cuv.

The Fierasfers are destitute of cirri, and their dorsal is so thin that it seems to be a mere fold of the skin; their natatory bladder is supported by two little bones only, the middle one being wanting.

One species is found in the Mediterranean,—*Ophidium imberbe*, L.†, whose teeth are small and crowded; and another,—*Oph. dentatum*, Cuv., which has two hooked teeth in each jaw. They are very small fishes.

AMMODYTES, Lin.

The Launces have the elongated body of the preceding fishes, and are provided with a fin, having articulated but simple rays, occupying a great part of the back, with a second behind the anus, and with a third, which is forked, at the end of the tail; these three fins, however, are separated by free spaces. The snout is very sharp; the upper jaw is extensile, and the lower one, when at rest, longer than the other. The stomach of these fishes is fleshy and pointed; they have neither cæca nor natatory bladder, and they live in the sand, whence they are taken after the tide has ebbed.

Two species are found on the coast of France, which were long confounded under the common name of *Ammodytes tobianus*, L., but which have lately been distinguished‡. They are,

* Add, the *Ophidium barbatum*, Mitch. I, f. 2, which appears to be a distinct species.

† It is the *Gymnotus acus*, Gm., and the *Notoptère fontanes*, Risso, ed. I, pl. iv, f. 11.

With the *Ophidium imberbe*, of the northern Ichthyologists, such as Schonefeldt, Montag., Werner. Soc. I, pl. ii, f. 2, and the *Ophidium viride*, Fab., Faun. Groenl. 148, I am unacquainted; I believe them, however, to be allied to the Eels.

The *Ophidium ocellatum*, Tiles., Mém. Ac. Petersb. III, pl. 180, iii, 27, seems to me to approach the Gunnelli.

‡ It is to M. Lesauvage, a learned physician of Normandy, that we owe this distinction, but he has transposed the name of *tobianus*. See the *Bullet. des Sc. Sept. 1824*, p. 141. There remains to be ascertained whether the *Ammodytes cicereillus*, Rafin., Caratt., pl. ix, f. 4, differs from the *tobianus*.

A. tobianus, Bl. 75, 2; Ray. I; Synop. III, f. 12, (The Lanccon), which has the lower jaw more pointed; the maxillaries longer; pedicles of the intermaxillaries very short, and in which the dorsal commences only opposite to the end of the pectorals; and

A. lancea, Cuv., Penn. Brit. Zool. pl. xxv, f. 66. (The Equille). The maxillaries shorter; pedicles of the intermaxillaries longer; the dorsal commencing opposite to the middle of the pectorals; the body thicker in proportion.

Both species are common along the whole coast of France; from eight to ten inches long, and of a silver-grey colour. They are excellent food, and are employed on fish-hooks as baits.

The whole of the fishes, of which we have been hitherto speaking, are furnished not only with a skeleton, which is either osseous or fibrous, together with jaws which are perfect as well as free, but also with branchiæ invariably consisting of laminæ or combs.

The Order of,

ORDER V.


LOPHOBRANCHIATE (*a*) FISHES,

Has also its jaws perfect and free, but it is eminently distinguished by the gills, which, instead of resembling, as usual, the teeth of a comb, are divided into small round tufts, arranged in pairs along the branchial arches, a structure of which no other fishes present any example. They are enclosed beneath a large operculum, tied down on all sides by a membrane which leaves only a single small orifice for the exit of the water, and exhibiting in its thickness only vestiges of rays. These fishes are also recognised by the scutellated plates of mail which cover their body, and almost always render it angular. They are generally small, and nearly without flesh. Their intestine is equal, and without cæca, and their natatory bladder thin, but very large.

SYNGNATHUS*, *Lin.*

The Syngnathi constitute a numerous genus characterized by a tubular snout, formed, like that of the Flute-mouths, by the prolongation of the ethmoid, vomer, tympanals, preopercula, subopercula, &c., and terminated by an ordinary mouth, but one that is cleft almost vertically on its extremity. The respiratory aperture is near the nape, and the ventrals are

* From two Greek words, *sun* and *gnathos*, (united jaws), a name composed by Artedi, who thought that the tube of the snout of these fishes was formed by the union of their jaws.

 (*a*) From the Greek, *lophos*, a tuft, and *branchiæ*, gills.—ENG. ED.

wanting. There is a peculiarity in the generation of these fishes, whose ova slip into a pouch formed by an inflation of the skin, and are hatched there; this pouch, in some, is situated under the belly, and in others under the base of the tail; it splits spontaneously for the passage of the fry.

SYNGNATHUS, properly so called, vulgarly designated, also, SEA-EELS,

Have an extremely elongated and very thin body, differing but little in diameter throughout its whole length. Several species are found in the seas of Europe.

Some of them, besides their ventrals, have a dorsal, a caudal, and an anal*.

In others the anal only is wanting†. In these two groups the pouch is situated under the tail.

Others again have neither anal nor pectorals, but are provided with a dorsal and caudal; their ovarian pouch is under the belly‡.

A fourth kind are deprived of every fin but the dorsal§.

HIPPOCAMPUS, Cuv.

The Hippocamps, vulgarly called Sea-Horses, have the trunk laterally compressed, and considerably more elevated than the tail; by curving after death the head and body assume some resemblance to the head and neck of a horse in miniature. The junctions of their scales are raised into ridges, and their salient angles into spines. The tail is without fins.

One species is found in the seas of Europe with a short snout, *Hipp. brevisrostris*, Cuv., Will. pl. J, 25, fig. 3; and another with a longer snout, *Hipp. guttulatus*, Cuv., Will. J, 25, f. 5, both of which have only a few filaments on the snout and body. There are others closely allied to these in the Indian Ocean||.

New Holland produces a larger one, which, from the leaf-like appendages that decorate various parts of its body, presents a most singular appearance: it is the *Syngnathus foliatus*, Shaw, Gen. Zool. V, ii, pl. 180; Lacép., Ann. du Mus. IV, pl. 58, f. 3. The

SOLENOTOMUS ¶, Séb. and Lacép.

This genus differs from *Syngnathus* in being furnished with very large ventrals behind the pectorals, united with each other and with the trunk, that form a kind of apron, which, like the pouch of the *Syngnathi*, serves

* *Syngnathus typhle*, L., Bl. 91, 1;—*Syng. acus*, L., Bl. 91, 2.

† *Syng. pelagicus*, Risso, p. 63;—*Syng. Rondeletii*, Laroche, Ann. Mus. XIII, 5, 5, *viridis*, Risso, 65, Rondel, 229, 1;—*S. barbarus*, Penn., Brit. Zool., or *rubescens*, Risso.

‡ *Syng. æquoreus*, L., Montag., Werner. Soc. I, 4, f. 1.

§ *Syng. ophidion*, L., Bl. 91, 3;—*Syng. papacinus*, Risso, IV, 7;—*Syng. fasciatus*, Id., Ib. 8.

|| *Syng. longirostris*, Cuv., Will. J, 25, f. 4, and other species to be described in our Ichthyology.

¶ *Solenostomus*, mouth like a tube, from *solen*, tube, and *stoma*, mouth.

to retain the ova. There is a dorsal with few, but elevated rays near the nape; another very small one on the origin of the tail, and a large pointed caudal; otherwise they closely resemble Hippocampus.

Only a single species is known, the *Fistularia paradoxa*, Pall., Spic. VIII, iv, 6; it inhabits the Indian Ocean.

PEGASUS, *Lin.*

The Pegases have a salient snout, formed, as in the preceding divisions, but the mouth, instead of being at its extremity, is under its base; it reminds us, by its protractility, of that of a Sturgeon, but is composed of the same bones as in ordinary fishes. The body is mailed like that of a Hippocampus and Solenostomus, but the trunk is broad and depressed, the branchial apertures are on the side, and there are two distinct ventrals behind the pectorals, which are frequently large, whence the name of the genus. The dorsal and anal are opposite to each other. The intestine, being lodged in a cavity wider and shorter than that of the Syngnathii, has two or three flexures.

Some species are found in the Indian Ocean*.

After describing the five orders of osseous or fibrous Fishes, with complete and free jaws, we pass on to the sixth order, or that of the


ORDER VI.

PLECTOGNATHES (*a*),

Which may be approximated to the Chondropterygii, with which it is allied slightly by the imperfection of the jaws, and by the slow process of the hardening of the skeleton; this skeleton, however, is fibrous, and generally its whole structure is that of ordinary fishes. The chief distinguishing character of the order consists in the maxillary bone being soldered or permanently attached to the side of the intermaxillary, which alone constitutes the jaw, and in the mode in which the palatine arch is united by a suture to the cranium, and consequently having no power of motion. Besides this, the opercula and rays are concealed under a thick skin, through which only a small branchial fissure is visible†. Of ribs, nothing is to be found but very small vestiges. There are no true ven-

* *Pegasus draco*, L., Bl. 209;—*Pegas. natans*, Bl. 121;—*Peg. volans*, L.;—*P. laterarius*, Cuv., whose snout is furnished with six longitudinal rows of dentations.

† This peculiar arrangement, indications of which are visible in the Chironectes, has led several naturalists to believe that both opercula and rays are wanting in the Plectognathes, but they are provided with them like other fishes.

 (*a*) From the Greek, *pleko*, to join as in a knot, *gnathos*, the jaw.

trals. The intestinal canal is ample, but without cæca*, and in almost every instance there is a large natatory bladder.

This order comprises two very natural families, characterized by the mode in which their teeth are armed, namely, the *Gymnodontes* and *Scærodermes*.

The first family, that of the

FAMILY I.

GYMNODONTES (*a*),

Has jaws, which, instead of teeth, are furnished with an ivory substance, internally divided into laminæ, which, in their aggregate, resemble a Parrot's bill, and which in fact consist of true teeth united, that succeed each other as fast as they are destroyed by trituration†. Their opercula are small, and there are five rays on each side, all of which are almost completely hidden. They live on Crustacea and sea-weed, their flesh is generally mucous, and that of several species is considered poisonous, at least in certain seasons.

Two of the genera, the *Tetraodons* and *Diodons*, vulgarly called Bloaters or Balls, have the faculty of swelling themselves up like a balloon, by filling their stomach, or rather a sort of very thin and extensible crop, which occupies the whole length of the abdomen, and adheres closely to the peritoneum, a circumstance which has occasioned it to be considered at one time as the peritoneum itself, and at another as a species of omentum, with air. When thus inflated, they roll over, and float on the surface, with the abdomen upwards, unable to direct their course; but they are extremely well defended while in this position by the erection of the spines with which their skin is everywhere furnished‡. Their natatory bladder has two lobes, and their kidneys, which are placed very high up, have been erroneously taken for lungs§. They have but three branchiæ on each side||, and when captured they produce a sound which

* Bloch erroneously attributes cæca to genus *Dodon*.

† See my *Leçons d'Anat. Comp.* vol. III, p. 125.

‡ See Sir Geoffroy St. Hilaire, *Poiss. d'Eg.*, in the great work on that country. A similar disposition is observable in *Chironectes*.

§ It is thus I explain the mistake of Schœpfer in the publications of the *Nat. of Berlin*, VIII, 190, and that of Plumier, *Schn.* 513, and doubtless that of *Garden*, *Lin. Syst.*, Ed. XII, i, p. 348. As to the cellular organs mentioned by Broussonnet, *Ac. des Sc.*, 1780, last page, there is nothing to be found which resembles them. The process of respiration in these fishes is similar in all things to that of others.

|| An instance of this we have already seen in *Lophius*.

is occasioned by the air rushing out of their stomach. Each of their nostrils is furnished with a double fleshy tentaculum.

DIODON, *Lin.*

The Diodons are so called because the jaws are undivided and formed of one piece above and another below. Behind the trenchant edge of each of these pieces is a round portion transversely furrowed, which constitutes a powerful instrument of mastication*. The skin is everywhere so armed with stout pointed spines, that, when inflated, they resemble the burr of a chestnut tree. A number of species inhabit the seas of hot climates.

Some of them have long spines supported by two lateral roots.

The most common of this group, *Diod. atinga*, Bl. 125, and better, Seb. III, xxxiii, 1, 2, is more than a foot in diameter†.

Others have short spines, proceeding from three diverging roots‡. Some again have spines as slender as pins or hairs§.

TETRAODON, *Lin.*

The Tetraodons have the jaws divided in the middle by a suture, so as to present the appearance of four teeth, two above and two below; spines on the skin small and low. Several species are said to be poisonous.

T. lineatus, L.; *Fahaca* of the Arabs; *Flasco psaro* of the Greeks; *T. physa*, Geoff., Poiss. d'Egypt. I, 1; Rondel. 419. Back and flank longitudinally striped with brown and whitish. From the Nile, which, during its inundations, casts thousands of them on shore, where they serve as play things for the children.

Some of them have a laterally compressed body, and a somewhat trenchant back; their power of inflation must be less than the others. One of them is electrical||.

* Fossil jaws of this description are not uncommon.

† The *Diod. hystrix*, Bl. 126, is the same species uninflated. To avoid all equivocation, I call it *Diodon punctatus*;—Add, *Diod. spinosissimus*, Cuv., Mém. Mus. IV, p. 134, Seb. III, xxiv, 10;—*Diod. triedricus*, Cuv., Mém. Mus. IV, p. 133, Seb. II, xxiii, 4;—*D. nictemerus*, Cuv., loc. cit. IV, vii, 5;—*D. novem-maculatus*, Id., Ib. VI, 3;—*D. sex-maculatus*, Id., Ib. VII, 1;—*D. multi-maculatus*, Id., Ib. 4.

‡ *Diod. tigrinus*, Cuv., Mém. Mus. IV, vi, 1, or *orbiculatus*, Bl. 127, Seb. III, xxiii, 3;—*D. rivulatus*, Cuv., Ib. 2, or *maculato-striatus*, Mitch. VI, 3, probably the *Orbe*, Lacép. I, xxiv, 3;—*D. jaculiferus*, Cuv., loc. cit. VII, 3;—*D. antennatus*, Id., Ib. 2.

§ *Diod. pilosus*, Mitchil. 1, 471.

|| The head and tail of the fishes of this genus are generally smooth, but the rest of their body is rendered more or less rough, by the very small spines which arise from the skin. The various combinations of the smooth and rough parts, and the different configurations resulting from the more or less oblique form of their head, have allowed me to arrange them in the following manner:—

I. Species with a short head, possessing the faculty of inflating themselves so as to attain a globular form.

1st. The entire body rough.

A. Immaculate;—*Tetr. immaculatus*, Lacép. I, xxiv, 1, Russel, I, 26.

B. With black spots;—*Tetr. moucheté*, Lacép. I, xxv, i, or *T. Commersonii*, Schn., Russ. I, 28;—*Tetr. fluviatilis*, Buchan. XXX, 1;—*Tetr. geometricus*, Bl. Schn., Catesb. II, xxviii.

C. With black bands;—*Tetr. fahaca*, or *T. physa*, Geoff., Poiss. d'Eg. I, 1;—*T. lineatus*, Bl. 141, to which the *Tetr. psittatus*, Bl., Schn. 95, is at least closely allied.

I separate from the genera of Diodons and Tetraodons,

CEPHALUS, *Sh.*—ORTHAGORISCUS, *Schn.*,

The Moles, vulgarly called Sun Fishes, which have the jaws undivided as in *Diodon*; but the body, compressed and spineless, is not susceptible of inflation, and the tail is so short and high that this fish resembles one whose posterior portion has been truncated, producing a singular appearance, which is amply sufficient to distinguish it. The dorsal and anal, both high and pointed, are united to the caudal; the natatory bladder is wanting; the stomach is small and penetrated directly by the ductus choledocus. A thick layer of a gelatinous substance is spread under the skin.

C. brevis, *Sh.*; *Tetr. mola*, *L.*; *Bl.* 128*. (The Short Sun Fish). Four feet and more in length, and weighing upwards of three hundred pounds; the skin is very rough, and of a fine silver colour. European seas.

C. oblongus; *Orthagoriscus oblongus*, *Bl.*, *Schn.* 97. (The Oblong Sun Fish). Skin hard, and divided into small angular compartments. Cape of Good Hope.

C. spinosus; *Orth. spinosus*, *Bl.* *Schn.*; *Diodon mola*, *Pall.*, *Spic. Zool.* VIII, pl. iv, f.; and better, *Kælr.*, *Nov. Com. Petrop.* X, pl. viii, f. 3. A third and very small species, with a few spines, which is sometimes taken in the Atlantic.

D. With pale spots;—*Tetr. testudineus*, *Bl.* 139, of which the *T. reticularis*, *Bl.*, *Schn.*, appears to be a variety;—*T. hispidus*, *Lacép.* I, xxiv, 2, and *Geoff. Poiss. d'Eg.* I, 2;—*T. patoca*, *Buchan.* XVIII, 2.

2nd. The entire body smooth: *T. levissimus*, *Bl.*, *Schn.*;—*T. cutcutia*, *Buchan.* XIII, 3.

3rd. The flanks only smooth, and with lateral tentacula: *T. Spengleri*, *Bl.* 144, *Seb.* III, xxiii, 7 and 8, the same as the *Tetr. Plumieri*, given from *Plumier*, *Lacép.* I, xx, 3. N.B. That which *Lacépède* considered a lump is only the pectoral of the other side, the point of which is visible, and that the *Sphéroïde tuberculé*, *Lacép.* II, 1, is drawn from the same plate of *Plumier*, and represents the same fish seen in front. *Schneider* was aware of this, *Bl.*, *Schn.*, *Ind.* pl. vii;—*T. honkenii*, *Bl.* 143.

4th. Smooth flanks, without lateral tubercles: *T. ocellatus*, *Bl.* 145;—*T. turgidus*, *Mitch.* pl. vi, f. 5;—*T. lunaris*, *Russel.* I, 29.

II. Species with an oblong head.

1st. The flanks only smooth: *T. argentatus*, *Lacép.*, *Ann. Mus.* IV, xiii.

2nd. Back and flanks smooth, the belly only rough: *T. lagocephalus*, *Bl.* 143, and *Seb.* III, xxiii, 5 and 6;—*T. levigatus*, *Will.*, pl. J, 2.

III. With a carinated back: *T. rostratus*, *Bl.* 146, 2, to which the *T. electricus*, *Paters.* *Phil. Trans.* vol. 76, pl. 3, is closely allied;—*T. Gronovii*.

* Add, *Ort. oblongus*, *Schn.* 97;—*Ort. varius*, *Lacép.* I, xxii, 2;—*Ort. hispidus*, *Nov. Com.*, *Petr.* X, viii, 2 and 3.

N.B. The *Ovoïde fascé*, *Lacép.* I, xxiv, 2, the *Ovum Commersonii*, *Schn.* 108, was described and figured by *Commerson* from a stuffed specimen which he himself suspected was a mutilated *Tetraodon*, and which, in fact, is a *Tetraodon lineatus* that had lost its fins.

The *Sphéroïde tuberculé* was given, as we have stated, from a drawing of *Plumier*, which represents a front view of a *Tetraodon* whose vertical fins are not visible. *Conf.*, *Schn.*, *Index*, LVII. These two genera must consequently be suppressed.

We also form a distinct genus of

TRIODON, *Cuv.*,

Triodons, whose upper jaw is divided as in the Tetraodons, and the lower one single, as in the Diodons. An enormous dewlap, almost as long as the body and twice as high, is supported before by a very large bone which represents the pelvis, and approximates them to certain Balistes. Their fins are those of a Diodon, their body is rough as in Tetraodon, and the surface of their dewlap is covered with numerous, small, rough crests, placed obliquely.

T. bursarius, Reinw.; *Triod. macroptère*, Less. and Garn., Voy. de Duper., Poiss. No. 4. The only species known; it was discovered in the Indian Ocean by M. Reinward.

FAMILY II.

SCEERODERMES.

The second family of the Plectognathes is easily distinguished by a conical or pyramidical snout, prolonged from the eyes and terminated by a small mouth, armed with a few distinct teeth in each jaw. The skin is usually rough, or invested with hard scales; the natatory bladder is oval, large and strong.

BALISTES*, *Lin.*

The Balistes have the body compressed; eight teeth in a single row in each jaw, generally trenchant; the skin scaly or granulated, but not exactly osseous; the first dorsal composed of one or more spines articulated with a particular bone which is attached to the cranium, marked by a furrow into which they are received; the second dorsal long, soft, and placed opposite to a nearly similar anal. Although the ventrals are wanting, a true pelvic bone is observed in the skeleton suspended to the bones of the shoulder.

These fishes abound in the torrid zone, near rocks which rise to the surface of the water, where they display their brilliant colours like the Chætodons. Their flesh, which is but lightly esteemed at all times, becomes, it is said, poisonous during the period in which they feed on the coralline Polypi; fucus is all that I met with in those I opened.

BALISTES, *proper*,

Have the entire body covered with very hard, large, rhomboidal scales,

* *Balistes*, a name given to these fishes by Artedi, from their Italian appellation *Pesce balestra*, which is itself derived from a supposed similitude between the motion of their great dorsal spine and that of a cross-bow.

which do not overlap, and have the appearance of compartments of the skin; the first dorsal has three spines, the first of which is much the longest, and the third very small and placed far back; the extremity of the pelvis is always salient and prickly, and behind it are some spines involved in the skin, which, in the long species, have been considered as rays of ventrals.

Some of them have no peculiar caudal armature, and of these, again, some have scales behind the gills, which are no larger than the others. Such is a species that inhabits the Mediterranean, the

B. capriscus, L.; Salv. 207, and Will. I, 19; *Poure, Pesce balestra*, &c. (The Mediterranean File-Fish). Brownish-grey, spotted with blue, or greenish. Its flesh is not esteemed*.

Others, with this unarmed tail, have scales behind the gills which are larger than the rest†.

In the greater number, the sides of the tail are armed with a certain number of rows of spines bent forwards, and all those of this division with which we are acquainted have scales behind the gills larger than the others‡.

MONOCANTHUS, Cuv.,

Have only very small scales, covered with stiff and thickly-set asperities, like the pile on velvet; extremity of the pelvis salient and spinous as in the true Balistes, a single large serrated spine in the first dorsal, or at least the second one is almost imperceptible.

* I suspect the *B. maculatus*, Bl. 151, is the same as the *capriscus*. I am even inclined to believe that such is also the case with the *B. buniva*, Lacép. V, xxi, 1.—Add, *Bal. stellaris*, Schn., Lacép. I, vi;—*Bal. sufflamen*, Mitch. VI, 2;—*Bal. jellaka*, Cuv., *Lamayellaka*, Russel, I, 22.

† *Bal. forcipatus*, Will. I, 22;—*Bal. vetula*, Bl. 150;—*Bal. punctatus*, Gm., Will., App. 9, f. 4. We might also distinguish the *Bal. noir*, Lacép. I, xv, remarkable for its upper lateral teeth, which are prolonged into canines, and for the great forks of its tail. N.B. The *B. niger*, Schn., does not differ from the Ringens;—*Bal. fuscus*, Schn., or *B. Grandes taches*, Lacép. I, 373, remarkable for its naked cheeks furnished with rows of tubercles.

‡ Species with two or three rows of spines. *Bal. lineatus*, Schn. 87, Renard, 217, or *B. lamouroux*, Quoy and Gaym., Voy. Freycin. pl. 47, f. 1? *Bal. cendré*, Lacép. I, xvii, 2, or *B. arcuatus*, Schn., Journ. de Phys., Juillet, 1774.

Species with three rows. *Bal. aculeatus*, L., Bl. 149, Lac. I, xvii, 1, Renard, I, 28, f. 154, and II, 28, f. 136;—*Bal. verrucosus*, L., Mus. Ad. Fred. XXVII, 57, the same as *B. pralin*, Lacép. I, 335, and the *B. viridis*, Schn.

Species with four or five rows. *Bal. écharpe*, Lacép. I, xvi, 1, or *Bal. rectangulus*, Schn., or *Bal. medinilla*, Quoy and Gaym., Zool. de Freycin. pl. 46, f. 2;—*Bal. conspicillum*, Schn., Renard, I, 15, f. 88, and Lacép. I, xvi, 3, under the improper name of *Baliste américain*—it is from the Indian Ocean;—*B. viridescens*, Schn., or *verdâtre*, Lacép. I, xvi, 3.

Species with six or seven rows. *Bal. armé*, Lacép. XVIII, 2. N.B. It is neither the *armatus* of Schn., nor, as he supposes, his *chrysopterus*;—*Bal. ringens*, Bl. 152, 2, or *niger*, Schn., or *silloné*, Lacép. I, xviii, 1.

Species with twelve or fifteen rows. *Bal. bursa*, Schn.; *B. bourse*, Lacép. III, 7, Renard, I, 7, and Sonnerat, Journ. de Phys., 1774.

Species in which the spines are not very sensible, and are reduced to small tubercles. *Bal. bridé*, Lacép. I, xv, 3;—*Bal. étoilé*, Lacép. I, xv, 1, or *B. stellaris*, Schn., or *Dondrum yellakak*, Russel, XXIII.

N.B. If the BALISTAPUS of Tilesius, Mem. Acad. Petersb. VII, ix, actually want the pelvis, it will form a subgenus immediately after the true Balistes.

In some of them the pelvic bone is very moveable, and is connected with the abdomen by a sort of extensible dewlap; strong spines are frequently observed on the sides of their tail*.

Others are distinguished by the sides of their tail being bristled with stiff setæ†.

Some, because their body is completely covered with small pediculated tubercles‡.

Others, again, because that same part is furnished with slender and frequently branched cilia§.

A fifth kind have none of these various characters||.

ALUTERES, Cuv.,

Have an elongated body covered with small and scarcely visible granules; a single spine is the first dorsal; the chief character is in the pelvis, which is completely hidden under the skin, and is without that spinous projection observed in the other *Balistes*¶.

TRIACANTHUS, Cuv.,

Are distinguished from all other *Balistes*, by a kind of ventrals, each of which is supported by a single large spinous ray, adhering to a non-salient pelvis. The first dorsal has three or four small spines behind a very large one. The skin is crowded with small scales, and the tail is longer than in the other subgenera.

But a single species is known; it inhabits the Indian Ocean**.

OSTRACION, Lin.

The *Coffres* have the head and body covered with regular bony plates instead of scales, soldered in such a manner as to form a sort of inflexible shield, which invests them, so that the only moveable parts are the tail, fins, mouth, and a sort of small lip with which the edge of their gills is furnished, all passing through holes in this coat of mail. The greater number of their vertebræ are also soldered together, and each of their

* *Balistes chinensis*, Bl. 152, 1;—*Bal. tomentosus*, Id. 148, which is not that of Linnæus, but the *Pira aca*, Marcgr. 154;—*Bal. japonicus*, Tiles., Mem. Soc. Moscow, vol. II, pl. 13;—*Bal. pelleon*, Quoy and Gaym., Zool. de Freycin. pl. 45, f. 3;—*Bal. geographicus*, Per., Cuv., Règn. Animal, pl. ix, f. 2.

† *Bal. tomentosus*, L., Seb. III, xxiv, f. 18, Gronov., Mus. VI, f. 5;—*B. à brosses*, *Bal. scopas*, Commers., Lacép. I, xviii, 3, agreeing with the description given by Linnæus of the *hispidus*, but neither with the character nor figure quoted by Seba.

‡ *Bal. papillosus*, Schn., White, p. 254.

§ *Bal. penicilligerus*, Péron., Cuv., Règne Animal, pl. ix, f. 3;—*Bal. villosus*, Ehrenb.

|| *Bal. hispidus*, L., Seb. III, xxxiv, 2;—*Bal. longirostris*, Schn., Seb. III, xxiv, 19;—*Bal. papillosus*, L.? Lacép. I, xvii, 3, under the name of *monoceros*, Clus., Exot., lib. VI, cap. xxviii;—*Bal. villosus*, Cuv.;—*Bal. guttatus*, Id.

¶ *Bal. monoceros*, L.; Catesb. 19;—the *monoceros* of Bl., which is different, 147;—*Bal. lævis*, Bl. 414;—*Acaramucu*, Marcgr. 163, also differing from the three preceding ones;—*Bal. Kleinii*, Misc. III, pl. iii, f. 2;—*Al. cryptacanthus*, Cuv., Ren. II, part of pl. xlii, f. 284.

** *Bal. biaculeatus*, Bl. 148, 2.

Numerous species of all these subgenera will be described in our Hist. des Poissons.

jaws is armed with ten or twelve conical teeth. The external branchial aperture is a mere slit furnished with a cutaneous lobe, but internally we find an operculum and six rays. Both the pelvis and ventrals are wanting, and there are but a single dorsal and ventral, both small.

They have but little flesh; their liver, however, is large, and produces much oil. Their stomach is membranous and large; some of them are considered poisonous.

They may be divided according to the form of their body and the spines with which it is armed; we are not certain, however, that there is not, in this respect, some sexual difference*.

The Second Series of the Class of Fishes, or the

CHONDROPTERYGIANS,

Can be considered neither as superior nor inferior to that of the ordinary fishes, for several of its genera approach the Reptiles in the conformation of the ear and of the genital organs, while, in others, the organization is so simple, and the skeleton so much reduced, that we might be excused for hesitating to place them among vertebrated animals at all. They therefore constitute a series somewhat similar to the first, as the Marsupialia, for instance, bear a resemblance to the other unguiculated Mammalia.

The skeleton of the Chondropterygians is essentially cartilaginous; that is, it contains no osseous fibres, the calcareous matter being deposited in small grains, and not in filaments; hence the absence of sutures in their cranium, which is always formed of a single piece, but in which, by means of projections, depressions, and holes, regions analogous to those in the cranium of other fishes may be distinguished. It sometimes

* 1st. A triangular body without spines. *Ost. triqueter*, Bl. 130;—*Ost. concatenatus*, Bl. 131.

2nd. A triangular body armed with spines behind the abdomen. *Ost. bicaudalis*, Bl. 132;—*Ost. trigonus*, Bl. 135.

3rd. A triangular body armed with spines before and behind the abdomen. *Ost. quadricornis*, Bl. 134.

4th. Triangular, the ridges armed with spines. *Ost. stellifer*, Schn. 97; the same as the *Ost. bicuspis*, Blunemb., Abb. 58.

5th. Triangular, without spines. *Ost. cubicus*, Bl. 137;—*Ost. punctatus* and *lenticinosus*, Schn., Seb. III, xxiv, 5; Lacép. I, xxi, 1, or *meleagris*, Sh., Gen. Zool. V, part II, pl. 172;—*Ost. nasus*, Bl. 138, Will. I, ii;—*Ost. tuberculatus*, Will. I, 10.

6th. A triangular body armed with spines before and behind the abdomen. *Ost. cornutus*, Bl. 133.

7th. A quadrangular body, the ridges armed with spines. *Ost. diaphanus*, Schn., p. 501;—*Ost. turritus*, Bl. 136.

8th. A compressed body, with a carinated abdomen and scattered spines. *Ost. auritus*, Sh., Nat. Misc. IX, No. 338, and Gen. Zool. V, part II, pl. lviii, 1, and some neighbouring species.

N.B. The *Ost. arcus*, Seb. III, xxiv, 9, is perhaps a mere variety of the *cornutus*; and the *gibbosus*, Aldrov. 561, appears to me to be a badly drawn *triqueter*.

happens that moveable articulations, which are found in other orders, are not met with in this one; part of the vertebræ of certain Rays, for instance, being united in a single body; some of the articulations of the bones of the face also disappear, and the most apparent character of this division consists in the absence of the maxillaries and intermaxillaries, or rather in their reduction to mere vestiges concealed under the skin, while their functions are fulfilled by bones analogous to the palatines, and even sometimes by the vomer. The gelatinous substance, which in other fishes fills the intervals of the vertebræ, and only communicates with them by a small hole, forms a long cord in several of the Chondropterygians, which traverses the bodies of almost all the vertebræ, without scarcely varying in diameter.

This series is divided into two orders—the Chondropterygians, whose branchiæ are free, like those of ordinary fishes, and those in which they are fixed, that is to say, attached to the skin by their external edge in such a manner that the water can only escape from their intervals through holes on the surface.

The first order of Chondropterygians, or the seventh of the class of Fishes:

ORDER I.

THE STURIONES, OR CHONDROPTERYGIANS WITH FREE GILLS.

The Fishes of this order are still closely allied to the ordinary fishes in their gills, which have but a single wide opening, and are furnished with an operculum, but without rays in the membrane. It comprises but two genera.

ACIPENSER*, *Lin.*

The general form of the Sturgeon is similar to that of the Shark, but the body is more or less covered with bony plates in longitudinal rows; the exterior portion of the head is also well mailed; the mouth, placed under the snout, is small and edentated; the palatine, soldered to the maxillaries, converts them into the upper jaw, and vestiges of the intermaxillaries are found in the thickness of the lips. This mouth, placed on a pedicle that has three articulations, is more protractile than that of the Shark. The eyes and nostrils are on the side of the head, and cirri are inserted under the snout. The labyrinth is perfectly formed in the cranial bone, but there is no vestige of an external ear. A hole perforated behind the temple is a mere spiracle, which leads to the branchiæ. The

* *Acipenser* is the antient name; *Sturio*, whence *Sturgeon*, is modern, and is probably the German name *Stoer* latinized.

dorsal is behind the ventrals, and the anal under it. The caudal surrounds the extremity of the spine and has a salient lobe beneath, shorter, however, than its principal point. Internally, we already find the spinal valve of the intestine and the united pancreas of the Selachii, but there is, moreover, a very large natatory bladder, which communicates with the œsophagus by a wide hole.

The Sturgeon ascends certain rivers in great numbers from the sea, and is the object of important fisheries; the flesh of most species is agreeable, their ova are converted into caviar, and their natatory bladder into isinglass. Western Europe produces

A. sturio, L.; Bl. 88. (The Common Sturgeon). Six or seven feet long: snout pointed; plates strong and spinous, arranged in five rows; the flesh resembling veal.

The rivers which empty themselves into the Black and Caspian seas, in addition to the *sturio*, produce three other species, and perhaps more*.

A. ruthenus, L.; *A. pygmæus*, Pall., Bl. 89. (The Small Sturgeon or Sterlet). Seldom more than two feet in length; plates of the lateral rows more numerous and carinated, those of the belly flat. It is considered a delicious fish, and its caviar is reserved for the Russian court. There is reason to believe that it is the *Elops* and the *Acipenser*, so highly celebrated among the ancients†.

A. helops, Pall.; *A. stellatus*, Bl. Schn.; Marsill., Dan. IV, xii, 2; the *Scherg* of the Germans; *Sevreja* of the Russians. Four feet in length, and has a longer and more slender snout, and rougher plates than the others. This species is prodigiously abundant, but is less valued than the Sturgeon.

A. huso, L.; Bl. 129; the *Hausen*, &c. (The Hausen, or Great Sturgeon). Blunter plates and a shorter snout and cirri than those of the Common Sturgeon; the skin also is smoother. It is frequently found to exceed twelve and fifteen feet in length, and to weigh more than twelve hundred pounds. One specimen was captured whose weight amounted to near three thousand pounds. The flesh is not much esteemed, and is sometimes unwholesome, but the finest isinglass is made from its natatory bladder. It is also found in the Po.

North America has several species of this genus which are peculiar to it‡.

* The various species of the Sturgeon are not yet well determined, and even Pallas, who knew more of them than any one else, does not give them sufficiently distinct comparative characters; he does not agree either with Kramer, Guldenstedt, or Lepechin. The figures of Marsigli, on the other hand, are too coarse. We expect better ones from the learned Austrian naturalists, to whom the Danube offers abundance of these fishes.

† See my note on Pliny, Lemair's Ed. vol. II, p. 74.

‡ *Acip. oxyrhynchus*, Lesueur, Amer. Philos. Trans., new series, vol. I, p. 394;—*Acip. brevirostris*, Id., lb. 390;—*Ac. rubicundus*, Id., lb. 388, and pl. xii, which appears to bear a close resemblance to the Sterlet;—*Ac. maculosus*, Id., lb. 392, approaches the Common Sturgeon.

POLYODON, *Lac.*—SPATULARIA, *Sh.*

These fishes are recognised at once by the enormous prolongation of their snout, to which its broad borders give the figure of the leaf of a tree. Their general form and the position of their fins remind the observer of a Sturgeon, but their gills are still more open, and the operculum is prolonged into a membranous point which extends to near the middle of the body. The mouth is well cleft and furnished with numerous small teeth. Their upper jaw is formed by the union of the palatines with the maxillaries, and the pedicle has two articulations. The spine of the back is furnished with a cord like that of the lamprey; and the spiral valve, common to almost all the Chondropterygians, is found in the intestine, but the pancreas begins to be divided into cæca—they have a natatory bladder.

But a single species is known, the *Polyodon feuille*, Lacép. I, xii, 3; *Squalus spatula*, Mauduit, Journ. de Phys. 1774, pl. 11. From the Mississippi.

CHIMÆRA *, *Lin.*

The Chimærae are closely allied to the Sharks in their general form and in the position of their fins, but all their branchiæ open externally by a single apparent hole on each side, although if we penetrate more deeply, we find that they are attached by a large part of their edges, and that in fact there are five particular holes terminating in the bottom of the common aperture. A vestige of an operculum, however, is concealed under the skin. The jaws are still more reduced than in the Shark, for the palatine and tympanic bones are also mere vestiges suspended to the sides of the snout, and the vomer is the only representative of the upper jaw. Hard and indivisible plates supply the place of teeth, four on the upper jaw and two on the lower. The snout, supported like that of a Shark, projects forwards, and is pierced with pores arranged in tolerably regular lines; the first dorsal, armed with a strong spine, is placed over the pectorals; the males are recognised, as among the Squali, by bony appendages of the ventrals, which are divided, however, into three branches, and they have, besides, two spinous laminæ situated before the base of these same ventrals; a fleshy appendage between the eyes is terminated by a group of small spines. The intestine of the Chimærae is short and straight, it is furnished, however, with the spiral valve, as in the Shark. They produce very large coriaceous eggs with flattened and hairy borders. In the

CHIMÆRA, *Cuv.*,

Or true Chimæra, the snout is simply conical; the second dorsal commences immediately behind the first and extends to the tip of the tail, which is drawn out in a long filament, and is furnished beneath with another fin similar to the caudal of a Shark. But one species is known,

C. monstrosa, L.; Bl. 124, and Lacép. I, xix, 1, the female;

* This name was given to them on account of their fantastic figure, which, when they are carelessly dried, as was the case with the specimens first represented by Clusius, Aldrovandrus, &c., appears monstrous.

vulg., *King of the Herrings*; the *Chat* of the Mediterranean. (The Arctic *Chimæra*.) Two or three feet long, of a silvery colour, and spotted with brown. It inhabits our seas, and it is caught generally in the wake of the Herrings. In the

CALLORHYNCHUS, *Gronov.*

The snout is terminated by a fleshy appendage resembling a hoe as to form. The second dorsal commences over the ventrals and terminates opposite the beginning of the fin attached to the under part of the tail. But one species is known.

Chim. callorhynch., L.; Lacep. I, xii, a female. (The Antarctic *Chimæra*.) From the South Seas.

ORDER II.

The Second Order of Chondropterygians or the Eighth of Fishes is that of the

FIXED GILLED CHONDROPTERYGIANS.

Which, instead of having those organs free on the external edge, and opening all their intervals into a large common orifice, as is the case in all the fishes of which we have hitherto spoken, have them adhering by this external edge in such a manner that they permit the water to escape through as many holes pierced in the skin as there are intervals between them, or, at least, that these holes may terminate in a common duct, through which the water is transmitted out. Another circumstance peculiar to these fishes is the presence of little cartilaginous arches, frequently suspended in the muscles opposite to the external edges of the branchiæ, and which may be termed branchial ribs.

FAMILY I.

SELACHII,—PLAGIOSTOMI, *Dumèr.*

This family, hitherto comprised under two genera, *SQUALUS* and *RAIA*, has many common characters. The palatines and post-mandibularies, alone armed with teeth, supply the place of jaws, the usual bones of which are reduced to mere vestiges; one single bone suspends these apparent jaws to the cranium, representing at once the tympanal, jugal and temporal bones, and the preoperculum. The hyoid bone is attached to the single pedicle just mentioned, and supports branchiostegal rays, as in ordinary fishes, although they are not so very visible, externally; it is followed by the branchial arches, as usual, but neither of the three pieces compose the operculum.

These fishes have both pectorals and ventrals: the latter are situated behind the abdomen, and on each side of the anus. Their membranous labyrinth is enclosed by the cartilaginous substance of the cranium; the sac, which constitutes part of it, contains mere amylaceous masses, and no stones. The pancreas resembles a conglomerated gland, and is not divided into distinct tubes or cæca. The intestinal canal is short in proportion, but a portion of it is provided internally with a spiral lamina, which prolongs the delay of the ailments.

Fecundation is performed by a real intromission of semen; the females have highly organized oviducts, which supply the place of a matrix in those whose young are hatched within their body; the others produce ova, invested with a hard or horny shell, to the formation of which a large gland that surrounds each oviduct contributes. The males are recognised by certain appendages, situated on the internal edge of the ventrals, which are very large, and highly complicated, and whose use is not well understood.

SQUALUS*, *Lin.*

The Sharks form a first great genus distinguished by an elongated body, a thick fleshy tail and moderate pectorals, so that the general figure approaches that of ordinary fishes; the branchial openings correspond with the sides of the neck, and not with the under surface of the body as we shall see is the case with the Rays; the eyes also are on the sides of the head. The snout is supported by three cartilaginous branches connected with the anterior part of the cranium, and the rudiments of the maxillaries, intermaxillaries, and premandibularies are evident in the skeleton.

The shoulder bones are suspended in the fleshy part behind the branchiæ without articulating either with the cranium or spine. Several are viviparous. The others produce ova invested with a yellow and transparent horn, the angles of which are prolonged into horny cords. The little branchial ribs are apparent, and there are also small ones along the sides of the spine, which is completely divided into vertebræ. The genus is very numerous and authorizes various subdivisions†. We first separate the

SCYLLIUM‡, *Cuv.*

Distinguished from other Squali by the short and obtuse snout, and by the nostrils opening near the mouth, continued in a groove extending to the edge of the lip, and more or less closed by one or two cutaneous

* *Squalus*, the Latin name of a fish, employed by some authors; the species, however, is unknown. Artedi applied it to this genus. We also find *Squalus* for *Squatina*.

† The flesh of this genus is generally of a leathery texture, and is used as food only by the neediest.

‡ *Scyllium*, one of the Greek names of this fish.

lobules. The teeth have a point in the middle, and two smaller ones on the sides. There are spiracles and an anal fin; the dorsals are placed very far back, the first never being further forward than the ventrals; the caudal is elongated, not forked and truncated; the branchial apertures are partly under the pectorals,

In some of them the anal corresponds to the interval between the two dorsals: such are the two species of the coast of Europe that are frequently confounded, or at least very indifferently distinguished, the

Sq. canicula, L.; *La Grande Roussette*; Bl., 114; Rondel., 380; Lacep. I, x, 1. Numerous small spots; the ventrals obliquely truncated.

Sq. catulus, and *stellaris*, L.; *La Rochier*; Rondel., 383; Lacep., I, ix, 2. Fewer but larger spots sometimes ocellated; ventrals cut square.

A third species from the same locality is marked with black and white spots.*

In others, all of them foreign to Europe, the anal is attached behind the second dorsal, the spiracles are singularly small, the fifth branchial opening is frequently concealed in the fourth, and nasal lobules are usually prolonged into cirri. † Under the name of

SQUALUS, properly so termed,

We include all the species with a prominent snout, under which are placed nostrils neither prolonged in a furrow nor furnished with lobules; there is a lobule on the under part of the caudal which approximates it more or less to the bifurcated form. The old arrangement may be preserved which is founded on the presence or absence of the spiracles and anal; in order to make it a natural one, however, we must increase the number of its divisions.

Species without spiracles, provided with an anal.

CARCHARIAS ‡, Cuv.

A numerous and by far the most celebrated tribe: with trenchant, pointed teeth, most commonly dentated on the margin. The first dorsal is far before the ventrals, and the second about opposite to the

* Add the *Roussette* of Artedi, Risso, Ed. II, f. 5, or *Squalus prionurus*, Otto.; —the *Roussette* of Gunner (*Squalus catulus*, Gunn.), Mém. Soc. Dronth., II, pl. i, which appears to be a peculiar species; —the *Sq. Edwardsii* (Edw., 289), under the erroneous name of the *Greater Cat-fish*, which would indicate the *Roussette*, and which is improperly quoted as the pretended *Sq. stellaris*; —the *Sq. africanus*, or *gallonné*, of Broussonnet (Sh., Nat. Misc. 346). N.B. That the term *longitudinalibus*, gratuitously added by Gmelin, is not correct; —the pretended *Sq. canicula*, Bl., 112, which is a distinct foreign species, unless it be a very uncommon variety of the *Catulus*.

† The *Sq. pointillé*, Lacep., II, iv, 3, the same as the *Sq. barbillon*, Brouss., (*Sq. barbatus*, Gm.), and as the *Sq. punctatus*, Schn., Parra., pl. 34, f. 2; —the (*Sq. tigre*, Lac., or *Sq. fasciatus*, Bl., 113 (*S. tigrinus* and *S. longicaudus*, Gm.); —the *S. lobatus*, Schn., Phil. Voy. pl. 43, p. 285; —the *Bokee sorra*, Russ., Corom., XVI.

‡ *Carcharias*, the Greek name of some large *Squalus*, synonymous with *Lamia*.

the anal. The spiracles are wanting; the nostrils are placed under the middle of the depressed snout, and the last branchial apertures extend over the pectorals.

Sq. carcharias, L.; Belon, 60.* (The White Shark.) This species attains the length of twenty-five feet, and is recognized by its teeth, which in the upper jaw nearly form isosceles triangles with rectilinear and dentated sides. The lower ones consist of narrow points placed on wider basis, terrific weapons, which are the dread of mariners. It would appear that it inhabits every sea, but its name has frequently been applied to other species with trenchant teeth.

Sq. vulpes, L.; Rondel., 387. (The Fox Shark.) Teeth forming pointed isosceles triangles in each jaw, and particularly distinguished by the upper lobe of the tail, which is as long as the entire body. The second dorsal and anal, on the contrary, are extremely small. †

Sq. glaucus, L.; Bl., 86. (The Blue Shark.) Body slender, of a slate-blue above; pectorals very long and pointed; upper teeth forming curvilinear triangles bent outwards: the lower ones straighter, all of them dentated. ‡ The

LAMNA, Cuv., §

Only differs from a true *Squalus* in the pyramidal snout, under the base of which the nostrils are placed, and in the locality of the branchial openings which are before the pectorals. The species that inhabits the seas of Europe.

Sq. cornubicus, Schn.; Lacep., I, ii, 3||. (The Porbeagle Shark), has a projecting carina on each side of the tail, and the lobes of its caudal are almost equal. Its size has often caused it to be confounded with the White Shark. ¶

* N.B. This figure of Belon is the only good one. Most of the others are incorrect. Bl., 119, is a very different species, which appears more allied to *Scymnus*;—Gunner, Mem. of Dronth., II, pl. x. and xi, the same described by Fabr., Groenl., 127, is another species also allied to *Scymnus*;—Rondel., 390, copied Aldrov., 383, is the *cornubicus*, as well as Aldrov., 388, where the anal is torn away and the jaws, Id., 382;—I will not name the monstrous figure of Gesner, 173, copied Will., B. 7;—Lacep., I, viii, 1, is the *Sq. ustus*.

† It is on this last character that the genus *ALOPIAS*, Raf., is founded.

‡ Add; *Sq. ustus*, Dum. (*Sq. carcharia minor*, Forsk.), Lac., I, viii, 1; *Requin à nageoires noires*. Quoy and Gaym., Zool. de Freycin. pl. 43. f. 1;—*Sq. glauque*, Lac., I, ix, 1, which differs from that of Bl.;—*Sq. ciliaris*, Schn., pl. 31, the cilia of which only denotes its extreme juvenility. The *Palasorrah* and the *Sorrawawah*, Russ., XIV. and XV, and a large number of new ones to be described in our Ichthyology.

§ *Lamna*, one of the Greek names of the *lamia*, which particular word I am prevented from using, as Fabricius has applied it to a genus of insects.

|| The *lamia*, Rondelet, 399, the *carcharias*, Aldrov., 383 and 388, are nothing more than the *cornubicus*, which attains a very large size, notwithstanding what Bl., Schn., p. 132, says to the contrary. The pretended jaws of the *carcharias*, given by Aldrov., 382, are also those of the *cornubicus*. It appears to be more common in the Mediterranean than the true *Squalus*.

¶ Add *Sq. monensis*, Sh., which has a shorter snout and sharper teeth;—*Isurus oxyrhynchus*, Rafin, Caratt., XIII, 1, is very possibly a species of this genus, perhaps the common one disfigured by the stuffer.

Species with spiracles and an anal.

GALEUS *, Cuv.

The general form of the Sharks, but differing in the presence of spiracles. But a single species is known that inhabits the seas of Europe. It is the *Sq. galeus*, L.; Bl, 118, Duham., Sect. IX, pl. xx, f. 1 and 2. † The

MUSTELUS †, Cuv.

Resembles the *Squali* and *Galei* in form, but in addition to the presence of spiracles as in the latter, the teeth are like small paving stones.

The two species are taken in the seas of Europe, which are confounded under the name of *Sq. mustelus*, L. § The

NOTIDANUS ||, Cuv.

Only differs from *Galeus* in the absence of the first dorsal.

Sq. griseus, L.; *Sq. vacca*, Schn.; Augustin Scilla, pl. xvii; *Le Grisot* ¶. Ash-coloured above, whitish beneath, and very remarkable for its six wide branchial openings, and for its teeth which are triangular above and serrated below; the snout is depressed and rounded like that of the shark.

Sq. cinereus, Gm. Seven very wide branchial openings; teeth similar to the lower ones of the *Griseus*; snout pointed like that of the *cornubicus* **. Both these species inhabit the Mediterranean ††. The

SELACHE ††, Cuv.

In addition to the form of the *Squali*, and the spiracles of the *Galei*, is furnished with branchial openings that are nearly large enough to encircle the neck, and with small conical and unemarginate teeth.

The common species, *Sq. maximus*, L.; Blainv., Ann. du

* *Galeus*, the generic name in Greek, of the *Squali*.

† It is also the *lamiola*, Rondel., 377, cop. Aldrov., 393 and 393, Salv., 130, I, cop. Will., B, 6. The enormous size sometimes attributed to it, is owing to the fact that the teeth and jaws, represented Lacep., I, vii, 2, and Hérissant, Ac. des Sc., 1794, have been referred to it—they belong, however, to a foreign species, which will be described in our Ichthyology.

‡ *Mustelus*, the Latin translation of *galeos*, a generic name for the *Squali*.

N. B. M. Rafin. unites *Scyllium Galeus* and *Mustelus*, in his genus *GALEUS*.

§ The *Emissole commune*, Rondel., 375, Salv., 136, f. 2, cop. Will., pl. B, 5, f. 1, and improperly cited as the *galeus*.

The *Emissole tachetée de blanc*, or *lentillat*—Rondel., 376, Bel., 71, cop. Aldrov., 393.

|| *Notidanus* (*Dry back*), the Athenian name of some *Squalus*.

¶ The teeth are well figured, but the fish itself very badly. It is the genus *HEXANCHUS*, Rafin.

** It is the genus *HEPTRANCHIAS*, Rafin., who erroneously states that it has no spiracles.

†† Messrs. Quoy and Gaym. have discovered, in the Indian Ocean a species of this subgenus which is all spotted with black, and has seven spiracles.

‡‡ *Selache*, a Greek name common to all the cartilaginous fishes.

Mus. tom. XVIII, pl. vi, f. 1, (The Basking Shark) has nothing of the ferocity of the Shark, although it surpasses it in size as well as all other squali. Individuals have been captured that were more than thirty feet in length. It inhabits the Arctic seas, but is sometimes driven on the coast of France by the strength of the north-east winds *.

CESTRACION, Cuv.

The spiracles, anal, and teeth like paving stones of the *Musteli*, with a spine before each dorsal as in *Spinax*; the pointed jaws projecting as much as the snout, with small pointed teeth in the middle, and very broad rhomboidal ones towards the angles, the ensemble of which resembles certain spiral shells.

But a single species is known, the *Sq. Philippi*, Schn., Phil., Voy. pl. 283, and the teeth: Davila, Cat., I, xxii.

Species without an anal but furnished with spiracles.

SPINAX, Cuv.

These, with *Galeus* and *Mustelus*, join with all the characters of a *Careharias*, the addition of spiracles, and are distinguished besides by the want of an anal, by several rows of small trenchant teeth, and by a strong spine before each dorsal.

Sq. acanthias, L.; Bl., 85. (The Picked Dog-Fish). Brown above; whitish beneath. The young, Edw., 288†, are spotted with white.

CENTRINA ‡, Cuv.

These fishes unite with spines, spiracles, and the deficiency of the anal as in *Spinax*, the position of the second dorsal over the ventrals and the shortness of the tail, give it a more clumsy appearance than is presented by any other species. The lower teeth are trenchant and placed in one or two rows; the upper ones are slender, pointed, and arranged in several rows. The skin is rough.

The species most common on the coast of France is the *Sq. centrina*, L.; Bl. 115.

* See the anatomy of this fish by M. de Blainville, loc. cit. N.B. The differences observed between the figures and descriptions of Gunner, Dronth., III, ii, 1. of Pennant, Brit. Zool., No. 44, of Home, Phil. Trans., 1809, and of Shaw, Gen. Zool. may be owing to the difficulty that attends all attempts to observe such large fishes, and may not be sufficient to establish species. Nor can I see in what particulars the *squalus elephas*, Lesueur, Ac. Nat. Sc. Philad., differs from this *maximus*.

† Add the *Sagre*, Brouss., (*Sq. spinax*, L.) Gunner, Dronth., Mem., II, pl. vii;—the *Aiguillat* Blainville, Risso, Ed. II, f. 6. N.B. The *SQUALUS uyatus*, Rafin., Caratt., pl. xiv, f. 2, does not differ from a *Spinax*, and is probably the *Squalus spinax*, L. His *DALATIAS nocturnus*, Ib., f. 3, is a *Spinax* whose spiracles escaped his observation. His *ETMOPTERUS aculeatus*, also, appears to me a *Spinax* drawn from a dried specimen. This author give it three branchial orifices, but he only allows the same number to the *Squat angelus*, which most certainly has five.

‡ *Kentrine*, the Greek name of this fish, from *Kentron*, sting. It is the *OXYNOTUS* of Rafin.

SCYMNUS* Cuv.

All the characters of the preceding fishes except the dorsal spines. They also are found on the coast of France.

The *Leiche* or *Liche*, Brouss., called, through a mistake, *Sq. americanus*†.

A species inhabits the Arctic seas which is said to be as ferocious and terrible as the White Shark‡, and the Indian Ocean produces another, remarkable for the smallness of its first dorsal §.

A third, the *Sq. ecailleux*, Brouss.; *Sq. squamosus*, Lacep., I, x, 3, under the false name of *Sq. liche*, is remarkable for the small raised and crowded scales resembling leaves, that cover its entire skin. Its snout is long and depressed.

We distinguish those species whose first dorsal is over the ventrals, and the second further back.

One of these is completely covered with small spines, the *Squale boucle*, Lacep., I, iii, 2; *Squalus spinosus*, Bl., Schn.

A second genus may be formed of the

ZYGÆNA, Cuv.—SPHYRNA, Raf.

Which to the characters of the Shark, add a form of head of which there is no other example in the animal kingdom. It is horizontally flattened and truncated before, the sides extending transversely in branches, which give it a resemblance to the head of a hammer; the eyes are placed at the extremity of the branches, and the nostrils on their anterior edge.

The most common species of the European seas, *Sq. zygena*, L.; *Z. malleus*, Valenciennes, Mém. Mus., IX, xi, 1; Parra, 32; Salv., 40; Will., B., 1, is sometimes twelve feet long ||.

* *Scymnus*, the Greek name of a Scyllium.

† Because Gmelin has confounded Cape Breton near Bayonne, with another Cape of the same name near Newfoundland. The *Sq. nicéen*, Risso, Ed. I, f. 6, is a bad drawing of the same fish; in Ed. II, f. 4, it is somewhat better. The *Dalatias sparophagus*, Raf., Car., XIII, 2, must also belong to this genus.

‡ It is the pretended *Sq. carcharias*, of Gunner, Dronth., II, x and xi, and of Fab., Groen., 127, and perhaps also that of Bl., 119, although he gives it an anal. This is probably the place for the *Sq. brevipinnis*, Lesueur, Ac. Nat. Sc. Philad. I, 122, which forms the genus *SOMNIOSUS* of that author, who does not, however, describe the teeth.

§ *Leiche Laborde*, Quoy and Gaym., Zool., Freycin. pl. 44, f. 2.

|| Add the species represented by Bl., 117, known by its nostrils, which are placed much nearer the middle (*Z. Blochii*, Nob.), Val., Mem. Mus. IX, xi, 2. Its second dorsal is also much nearer the caudal:—the broad-headed species under the name of *pantouffier*, Lacep., I, vii, 3. It is the *pantouffier* of Risso *Zyg. tudes*, Val., Mem. Mus. IX, xii, 1, *Koma sorra*, Russel, XII, 2:—The true *pantouffier* (*Sq. tiburo*, L., and Val., loc. cit. XII, 2), Marcgr., 181, known by its heart-shaped head. N.B. The tail of Bloch's figure is twisted, whence the error of Schn., p. 131—*Caudæ inferiore lobo longiore*.

SQUATINA*, *Dumér.*

The Angels have Spiracles, but no anal, as in the third division of the Squali, but differing from all of them in the mouth, which is cleft at the end of the snout and not beneath, and in the eyes, which are placed on its dorsal surface and not on the sides. The head is round, the body broad and horizontally flattened, the pectoral large and extending forwards, but separated from the body by a fissure where the branchial orifices are pierced; the two dorsals are behind the ventrals, and the caudal is equally attached both above and beneath. The

Squat. angelus; *Squalus squatina*, L.: Bl., 116† (The Angel-Fish), attains a considerable size in the European seas. Its skin is rough, and the edges of the pectorals are furnished with small spines. (a)

PRISTIS ‡, *Lath.*

The Saw-fishes form a fourth genus. To the elongated form of the Squali it unites a body flattened before and branchiæ opening below, as in the Rays; but its peculiar character consists in a very long depressed snout resembling the blade of a sword, armed on each side with stout, bony, trenchant and pointed spines, planted like teeth. This beak, from which these fishes derive their name, is a most powerful weapon, and with it they attack the largest Whales. The true teeth of their jaws resemble small paving stones, like those of a *Mustelus*.

The common species, *Pristis antiquorum*, Lath.; *Squal. pristis*, L. The Saw-fish attains a length of twelve or fifteen feet.

RAIA §, *Lin.*

The Rays forms a less numerous genus than the Squali. They are recognised by the horizontally flattened body which resembles a disk, from its union with the extremely broad and fleshy pectorals which are joined to each other before or to the snout, and which extend behind the two sides of the abdomen as far as the base of the ventrals. The scapulæ of these pectorals are articulated with the spine behind the branchiæ. The eyes and spiracles are seated on the dorsal surface, the mouth, nostrils, and orifices of the branchiæ on

* *Rine*, in Greek, *Squatina* and *Squatius* in Latin: the ancient names of this fish still used in Greece and Italy.

† Add *Squat. aculeata*, *Dumér.*, of the Mediterranean, which has a row of strong spines along the back;—*Squat. Dumerilii*, Lesueur, Ac. Nat. Sc. Philad., I, x, with a granulated skin, &c.

‡ *Pristis*, (a saw) the Greek name of this fish. Species: *Pristis antiquorum*;—*Pr. pectinatus*;—*Pr. cuspidatus*;—*Pr. microdon*;—*Prist. cirrhatus*. See Lath., Trans. of the Lin. Soc. vol. II, p. 282, pl. 26 and 27;—*Pristis semi-cagittatus*, Shaw., Russel, I, 13.

§ *Raia*, in Latin, *Batis* and *Batos*, in Greek, are the ancient names of these fishes,

☞ (a) The Romans used this skin for polishing wood and ivory, as Pliny states; and it is still used as shagreen—ENG. ED.

the opposite one. The dorsal fins are almost always on the tail. The ova are brown, coriaceous, and square, the angles extended into points. We subdivide the genus as follows:

RHINOBATUS*, *Schn.*

The Rhinobati connect the Rays with the Squali by their thick fleshy tail, furnished with two very distinct dorsals and a caudal; the romboid formed by their snout and their pectorals is acute in front and narrower in proportion than in ordinary Rays. Independently of this they have all the characters of the latter genus; their teeth are crowded and planted in a quincunx order like small flat paving-stones.

Some of them still have the first dorsal on the ventrals †.

In others it is much further back.

Such are the Mediterranean species, *R. rhinobatus*, L.; Will., D, 5, f. 1; and that of Brazil, *R. electricus*, Schn., Marcgr. 152, which has been said to participate in the properties of the Torpedo; this, however, has not been proved.

There is another species, *Rh. granulatus*, the skin of which is granulated ‡. The

RHINA, *Schn.*

Only differ from the Rhinobat in a short, broad, and rounded snout §.

TORPEDO ||, *Dum.*

The Torpedos have the tail short, but still tolerably fleshy; disk of the body nearly circular, the anterior border being formed by two productions of the snout which incline side-wise in order to reach the pectorals; the space between these pectorals, head and branchiæ is filled on each side with a singular apparatus formed of little membranous tubes placed close together like a honeycomb, subdivided by horizontal diaphragms into small cells filled with a sort of mucus, and traversed by numerous nerves proceeding from the eighth pair. It is in this apparatus that resides the electric or galvanic power which has rendered the Torpedo so celebrated; violent shocks are experienced by touching it, and it is most probable that the same power is

* *Rinobatos*, which Gaza translates by *Squatino-raia*, is the Greek name of these fishes, which were considered by the ancients as produced from the union of the Ray with the Squatina.

† *Rhin. lævis*, Schn. 77, Russel, 10, and *Rh. Djiddensis*, Forsk., 18, which probably form but one species. It is to it must be referred the fig. of the *Rhinobate*, Lacep., V, vi, 3, and that of Duhamel, part II, Sect. IX, pl. xv.

‡ N.B. The *R. thouin*, Lacep., 1, 1, 3, is a variety of the common *Rhinobatus*. The *Raia halavi*, Forsk., also appears to be the same. Add the *Suttivara*, Russ., XI.

§ *Rhina ancylostomus*, Bl., Schn., 72, to which the editor improperly adds the *Raie chinoise*, Lacep., I, ii, 2, which, as well as can be determined from a Chinese figure, rather approaches the Torpedo.

|| *Torpedo, narke*, ancient names of these fishes, derived from their benumbing faculty.

employed to bewilder its prey. The body is smooth, the teeth small and sharp.

Several species are found in the seas of Europe confounded by Linnæus and most of his successors under the name of *Raia torpedo* *.

T. narke, Riss.; Bl., 122; Rondel., 258 and 362. (The Ocellated Torpedo). Number of spots varying from five to one; no fleshy indentations on the edges of the spiracles.

T. galvanii, Riss.; Rondel. 363, 1. (The Galvanic Torpedo). Seven fleshy indentations round the spiracles; sometimes of a uniform fawn colour, and sometimes marbled, dotted, or spotted with blackish.

Several others are found in foreign seas †.

RAIA, Cuv.

The rays, properly so called, have a rhomboidal disk, a thin tail, furnished above and near its point with two small dorsals, and sometimes with the vestige of a caudal; small, slender, and crowded teeth in quincunx order in the jaws. Many species inhabit the seas of Europe which are not yet well determined. Their flesh, though hard, is eaten.

R. clavata, L.; the male, Bl., 84, under the name of *rubus*, the female. (The Thornback.) Distinguished by its roughness and the thick, oval, bony tubercles, each of which is furnished with a recurved spine, that are irregularly scattered over its two surfaces. Their number varies greatly.

R. rubus, L.; Lacep., I. v (The Rough Ray), differs from the Thornback in the absence of the tubercles. The male of both species, however, has hooked spines on the front and angle of the wings, their posterior edge being similarly furnished in the female. The appendages of the male are very long and complex‡.

R. batis, L.; *R. oxyrinchus major*, Rondel., 348. (The Skate, or white, or ash-coloured Ray.) Superior surface of the body rough, but spineless, with a single row of spines on the tail. It is the largest of all the species, and is sometimes found to

* The *Torpille vulgaire à cinq taches*. *Torpedo narke*, Riss., Rondel., 358 and 362. *Torpedo unimaculata*, Riss., pl. iii, f. 3.

T. marmorata, Id., Ib., f. 4, Rondel., 362.

T. galvanii, Id., Ib., f. 5, Rondel., 363, f. 1.

† *Temere*, Russel, I;—*Nallatemere*, Id., 2;—the *Raie chinoise*, Lacep., I, ii, 2. Both of them being the *Raia timlei*, Bl., Schn., 359.

‡ N. B. The *R. batis*, Penn. Brit. Zool., No. 30, is nothing more than this *rubus*, Lacep. The *rubus*, Bl., 84, which is the *R. clavata*, Will., is, if not a species, at least a variety remarkable for the tubercles that are scattered over both surfaces. There is also a variety, *R. oculata aspera*, Rondel., 351, marked with an ocellated spot on each wing.

weigh upwards of two hundred pounds. It is spotted when young, assuming a more uniform and a paler tint with age*.

In some species of Rays, individuals have been observed with a recurved membrane on the middle of the disk, resembling a fin. Such, in the *R. aspera*, is the *Raie Cuvier*, Lacep., I, vii, 1. I have seen the same in a *R. batis*. The

TRYGON, *Adans* †.

Is recognised by the tail armed with a spine notched on both sides, and the small, slender, and crowded teeth arranged in quincunx order. The head, like that of the common Ray, is enveloped by the pectorals, which generally form a very obtuse disk.

The tail of some is slender and barely furnished with a fold in the form of a fin; of this number some have a smooth back. Such is

R. pastinaca, L.; Bl., 82. (The Sting Ray). Disk, round and smooth; inhabits European seas, where its spine is considered venomous, on account of the dangerous nature of the wounds inflicted by its serrated edges‡.

The back of others is more or less spinous§, or tuberculated ||.

Some again have a wide membrane on the under surface of the tail, and the species, *R. Sephen.*, Forsk.¶, whose back, crowded with osseous tubercles, furnishes us with shagreen, is of this number. The rounded body of one of them is even covered with small spines, and the tail with tubercles like those on the *R. clavata*,—*R. Gesneri***, Cuv. Several, however, have a smooth back††.

* Add the *R. undulata*, Lacep., IV, xiv, 2, which differ but little, or not at all, from the *mosaïque*, Id., 1b., XVI, 2;—the *R. chardon* (*R. fullonica*, L.), Rondel., 356, figured under the name of *oxyrhinchus*, Bl., 80, and Lacep., I, vi, 1.;—the *R. rudula*, Laroche, An. Mus., XIII, 321. is closely allied to it.—The *R. lentillat* (*R. oxyrhinchus*), Rondel., 347, of which the *Raie bordée*, Lacep., V, xx, 2, or the *R. rostellata*, Risso, pl. 1, and 2, *Læviraia*, Salv., 142, is also a closely allied species;—*R. asterias*, Rondel., 350, and Laroche, An. Mus. XIII, pl. xx, f. 1.; *R. miraletus*, Rondel., 349;—*R. aspera*, Rond., 356.

Observe that no reliance whatever is to be placed upon the synonymes given by Artedi, Linnaeus, and Bloch, as they are in a state of complete confusion, a circumstance principally owing to the fact of their employing, as a chief character, the number of rows of spines on the tail, which varies both with the age and sex, and cannot serve to distinguish the species. That of sharp or blunt teeth is likewise exceedingly doubtful in its application.

† *Pastinaca Trygon*, or *Turtur*, ancient names of these fishes.

‡ Add *Tenkée Shindraki*, Russ., I, 5.

§ The *Raie tuberculée*, Lacep., I, iv, 1, in which the engraver has omitted the caudal spine;—*Raia Sabina*, Lesueur, Ac. Nat. Sc. Phil.

|| *Isakurrah-Tenkée*, Russ., I, 4.

¶ Add *Wolga-Tenkée*, Russ., I, 3.

** They only had the figure of the tail, Gesner, 77.

†† *R. lymna*, Forsk., p. 17. It is at least a very closely allied species which is figured, but without a spine, under the name of *torpille*, Lacep., I, vi, 1, and perhaps it is also the *P. grabatus*, Geoff., Eg. Poiss., Bl., XXV, i, 1. N. B. The *lymne*, Lacep., I, iv, 2 and 3. is merely a common Trygon;—*R. jamaïcensis*, Cuv., Sloane's Jam., pl. 246, f. 1.

In some again the slightly elongated and thick tail is terminated by a fin*.

Finally, in others the extent of the wings renders the body very broad and the tail very short †. The

ANACANTHUS, *Ehrenb.*

Resembles a Trygon, but the long and slender tail has neither fin nor spine. There is a species in the Red Sea whose back is furnished with a coarser shagreen than that of the Sephen, and with stellated granules ‡.

MYLIOBATIS §, *Dumér.*

Have the head projecting beyond the pectorals, which are larger transversely than in other Rays, giving them somewhat the appearance of a bird of prey with outstretched wings, which has caused them to be compared to the Eagle. The jaws are furnished with broad flat teeth, placed like flags in a pavement, and differing in size according to the species; their extremely long and slender tail terminates in a point and is armed, like that of a Trygon, with a strong spine notched on both sides, supporting near its base and before the spine, a small dorsal. Sometimes there are two or more spines ||.

The snout of some projects in a parabola. Such as

R. aquila, L.; *Aigle de mer*; *Mourine*; *Ratepenade*; *Bœuf*; *Pesce ratto*, &c.; Duham., part II, Sect IX, pl. x.; and the teeth, Juss. Ac. des Sc., 1721, pl. 17¶. (The Sea Eagle.) The middle plates of its jaw are much wider than they are long, and placed in a single row; the lateral ones, which are regular hexagons, in three rows**. It attains a large size, and is found in the Mediterranean and the Atlantic.

In others, the RHINOPTERA, Kuhl, the snout is divided into two short lobes, under which are two similar ones ††.

* The *Raie croisée*, Lacep., Ann. Mus., IV, lv, 2.

† *P. kunsua*, Cuv., *Tenkée kunsu*, Russel, I, 6.;—*R. Maclura*, Lesueur, Ac. Nat. Sc. Phil., or *micrura*, Bl., Schn., 360.

‡ The *Aiereba*, Marcgr., 175 (*Raia orbicularis*, Bl., Schn.), belongs, perhaps, to this division.

§ *Muliobatos*, from mule (grindstone), referring to the form of the teeth.

|| See the tail with five spines, Voy. de Freycin., Zool. 42, f. 3.

¶ N. B. The fig. of Bloch, 81, is not that of the *aquila*, but of a Trygon with a fin placed before the spine.

** Add: *Myl. bovina*, Geoff., Eg. Poiss., pl. xxvi, f. 1.;—*R. narinari*, L., Marcgr., 75, and under the name of *aigle*, Lacep., I, vi, 2, and the teeth, Phil. Trans., Vol. XIX, No. 283, p. 673. *Eel tenkee*, Russ., I, 8, found in both hemispheres;—*R. flagellum*, Schn., 73. His *R. nieuhowii*, Will. App., X, *Mookarra tenkee*, Russ., VII, perhaps only differs from it in the loss of the spine. The teeth are like those of the *aquila*;—*R. Jussieu*, Cuv., has the middle teeth broader than they are long, and in three rows. Juss. Ac. des Sc., 1721, pl. iv, f. 12.

†† *Myliobatis marginata*, Geoff., Eg., Poiss., pl. xxv, f. 2.;—*Raia quadriloba*, Lesueur, Ac. Nat. Sc. Phil.

CEPHALOPTERA, *Dum**.

Have the tail slender; the spine, small dorsal, and the pectorals broad, as in *Myliobatis*; but the teeth are still more tenuous than those of a *Trygon* and finely serrated. The anterior part of the head is truncated, and the pectorals, instead of clasping it, have each of their anterior extremities extended into a salient point, which gives the fish the appearance of having horns.

A gigantic species is occasionally captured in the Mediterranean, the *Raia cephaloptera*, Schn.; *Raie giorna*, Lacep. V, xx, 3, † with a black back bordered with violet.

FAMILY II.

The Chondropterygians of the second family are

SUCTORII.—CYCLOSTOMI, *Dumer.*

The Suckers, which, as regards the skeleton, are the most imperfect of fishes, and even of all vertebrate animals. They have neither pectorals nor ventrals; their elongated body is terminated before by a circular or semicircular fleshy lip, and the cartilaginous ring which supports it results from the soldering of the palatines to the mandibularies. The bodies of all the vertebræ are traversed by a single tendinous cord filled with a mucilaginous substance without strangulations, which reduces them to the condition of cartilaginous rings, scarcely distinct from each other. The annular portion, a little more solid than the rest, is not, however, cartilaginous throughout the whole of its circle. They have no ordinary ribs; but the small branchial ones, which are hardly perceptible in the *Squali* and *Rays*, are here greatly developed and united with each other, forming a kind of cage; while there are no solid branchial arches. The branchiæ, instead of being pectinated as in all other fishes, resemble purses, resulting from the junction of one face of a branchiæ with the opposing one of its neighbour. The labyrinth of the ear is enclosed by the cranium, and the nostrils open externally by a single orifice, in front of which is a blind cavity ‡. The intestinal canal is straight and thin, with a spiral valve.

* *Cephaloptera*, winged head, from the projection of the pectorals.

† The *Raie fabronienne*, Lacep., II, v, 1, 2, is most probably a mutilated individual of the *giorna*, but the *R. giorna*, Lesueur, Ac. Nat. Sc. Philad. appears to differ from that of the Mediterranean, and may rather be the *Mobular*, Duham., second part, Sect. IX, pl. 17. As to the *R. banksienne*, Lacep., II, v, 3.;—*Manatia*, Id., I, vii, 2.;—*Diabolus marinus*, Will., App. IX, 3; they unfortunately rest on no authentic foundation. Add the *Cephaloptera massena*, Riss., p. 15;—*Eregoodootenkee*, Russ., I, 9.

‡ Improperly styled a spiracle. With respect to this family in general, see Dumeril, Diss. sur les Poiss. Cyclostomes.

PETROMYZON,* *Lin.*

The Lampreys have seven branchial openings on each side; the skin of the tail above and beneath is turned up into a longitudinal crest which supplies the place of a fin, but in which the rays resemble scarcely visible fibres.

PETROMYZON, *Dumer.*

The maxillary ring of the True Lamprey is armed with strong teeth, and the interior disk of the lip, which is very circular, is furnished with tubercles covered with an extremely hard shell, and similar to teeth. This ring is suspended under a transverse plate which appears to supply the want of intermaxillaries, and on the sides of which vestiges of maxillaries may be observed. There are two longitudinal rows of small teeth on the tongue, which moves backwards and forwards like a piston; by this, that suction is produced which distinguishes the animal. Water reaches the branchiæ from the mouth by a particular membranous canal, placed under the œsophagus and perforated with holes, that may be compared to a trachea. There is a dorsal before the anus and another behind it, which unites with that of the tail. These fishes habitually fix themselves by suction to stones and other solid bodies; they attack the largest fishes in the same way, and are finally able to pierce and devour them.

P. marinus, L.; Bl., 77; the teeth better in Lacep. I, i, 2. (The Greater or Sea Lamprey.) Two or three feet in length, mottled with brown on a yellowish ground; first dorsal very distinct from the second; two large approximated teeth on the upper part of the maxillary ring. It ascends the mouths of rivers in the spring, and is highly esteemed.

P. fluvialis, L.; *Pricka*; *Sept-Oeil*, &c.; Bl., 78, 1. (The Lesser or River-Lamprey.) From a foot to eighteen inches in length; silvery, blackish and olive on the back; first dorsal very distinct from the second; two large separated teeth on the maxillary ring. Inhabits rivers, &c.

P. planeri, Bl.; *Sucet*, &c.; Gesner, 705. (Small River Lamprey.) From eight to ten inches long; teeth and colours of the *fluvialis*; the two dorsal contiguous or united. Rivers, &c. (†)

MYXINE, *Lin.*

But a single tooth on the upper part of the maxillary ring, which is

* *Lamproye Lampreda*, Lamprey, corruptions of *Lampetra*, which is itself modern, and, according to some, derived from *Lambendo*, *petras*. *Petromyzon* is the Greek translation of the same, by Artedi. It is somewhat singular that so much uncertainty should envelope the ancient name of a fish so much esteemed, and so common in the Mediterranean.

† N.B. The figure of the *Planeri*, Bl., 78, 3, is a young *fluvialis*. I also think that the *Petrom. sucet*, Lacep., II, 1, 3;—*sept-oeil*, IV, xv, 1;—*Noir*, Ib., 2, are mere varieties of the *planeri*: but the fig. I, ii, 1, under the name of *Lamproyon*, *Petrom. branchialis*, represents a peculiar species of this genus, and not an *Ammocætes*. I see no difference between the *Petrom. argenteus*, Bl., 415, 2, and the *fluvialis*.

altogether membranous, lateral dentations of the tongue strong, and arranged in two rows on each side, so that the jaws of these fishes seem to be lateral like those of insects or the Nereides, which induced Linnæus to place them in the class of Vermes; the rest of their organization, however, is analogous to that of the lampreys.* the tongue also acts like a piston, and the spine of the back is in the form of a cord. The mouth is circular and surrounded with eight cirri; in its upper margin is a spiracle which communicates with its interior. The body is cylindrical, and furnished behind with a fin that surrounds the tail. The intestine is simple and straight, but wide and plaited internally; the liver bilobate. There are no vestiges of eyes. The eggs become large. These singular animals pour out such an abundance of mucus through the pores of their lateral line, that the water of the vases in which they are kept seems to be converted into a jelly. They attack and pierce other fishes like the lampreys.

They are subdivided according to the external orifices of their branchiæ. In

HEPTATREMUS, Dumer.

There are still seven holes on each side, as in the lampreys.

But a single species is known, *Gastrobranche domhey*, Lacep., I, xxiii, 1; *Petromyzon cirrhatus*, Forster; Bl., Schn., p. 532; from the South Seas.†

GASTROBRANCHUS, Bl.

The intervals of the branchiæ, instead of having separate issues, communicate with a common canal on each side, each of which terminates in a distinct hole situated under the heart, near the first third of the whole length.

But a single species is known, *Myxine glutinosa*, L.; *Gastrobranchus cæcus*, Bl., 413; the (Glutinous Hag.) From the Arctic Ocean.

AMMOCETES, Dumer.

All the parts which should constitute the skeleton, so soft and membranous that they are hardly entitled to the appellation of bone. The general form of these fishes, and external orifices of the branchiæ are similar to those of the lampreys, but their fleshy lip is cemicircular, and only covers the top of the mouth, consequently they cannot attach themselves to bodies like a true lamprey. They have no teeth, but the opening of their mouth is furnished with a row of small branched cirri. They have no particular trachea, and their branchiæ are supplied with water from the œsophagus as usual. Their dorsals are united with each other and with the caudal, forming a low and sinuous fold. They inhabit the ooze of brooks, and

* See the Memoir of Abildgaard, Trans. Soc. Nat. Berlin, vol. X, p. 193.

† See the Memoir of Sir Ev. Home, Phil. Trans., 1815.

their habits are greatly like those of worms, which they otherwise so strongly resemble.*

One of them is found in France, the *Petrom branchialis*, L.; Lamprillion, Civelles, &c. (the Common Pride.) From six to eight inches long, and the size of a large quill; it has been accused of sucking the branchiæ of fishes, possibly from having confounded it with the *Petrom planeri*. It is used as bait.(a)

* See *Omalus de Hallois*, Journ. de Phys., May, 1808.

N.B. The *Petrom. rouge*, Lacep., II, i, 2, belongs to this genus, and perhaps does not differ materially from the common species quoted.

§ (a) Some pains having been taken within the last few years to determine the species of the class of fishes which frequent the coast of Cornwall, we feel that to supply the results of this investigation, would be by no means useless or uninteresting. Great praise is due to Mr. Cornish of Polpero, for his long continued exertions in this department. In this gentleman's description, he employs the classification of Linnæus. We shall present the species furnished by Mr. Cornish, in the manner in which he has arranged them, and also according to the classification of Cuvier.

The fishes were divided by Linnæus into four orders, the Apodes, Jugulares, Thoracici, and Abdominales. The Cornish fishes are distributed by Mr. Cornish according to this classification.

ORDER I.—APODES.

Fishes with a smooth slippery skin, generally naked, or covered in some species only with small soft scales which are distant from each other. Body slender, teeth in the jaws, live mostly in the sea, but some are found in rivers and ponds.

Murdua Anguilla, the eel, found in rivers near the coast. The eel as has recently been determined is oviparous, the only reason which previously led to the notion of its being viviparous, was that a couple of parasitical worms were usually found in its interior, which were mistaken for the offspring. This species belongs to the fourth order of Malacopterygians, the Apodal Malacopterygians of Cuvier, which see.

Mur. Conger, the Conger Eel, found in rocky ground on the Cornish coast.

Xiphias Gladius, the Sword Fish, very frequent.

Ammodytes Tobianus. Mr. Cornish states that this is the Launce, but the Launce evidently is the *Leptocepholus*.

ORDER II.—JUGULARES.

Fishes with ventral fins, placed more forward than the pectoral fins, or under the throat. These fishes belong to the order Acanthopterygians of Cuvier.

Callionymus Lyra, the Dragon fish, or gemmeous Dragonet. Rare.

C. Dracunculus, the Skulpin.

Trachinus Draco, the great Weever. The puncture of the dorsal fin of this fish is poisonous.

Gadus Oglefinus, the Haddock.

G. Morhua, the Cod-fish.

G. Luscus, the Bib.

G. Minutus, the Poor.

G. Molva, the Ling.

G. Mustella, the five bearded Cod, or more commonly called Rock Ling.

G. Merlangus, the Whiting.

G. Pollachius, the Pollack.

G. Carbonarius, the rauning Pollack, or Coal fish. *Rauning* is a Cornish word for raving, this fish being exceedingly voracious.

G. Merlucius, the Hake; this fish appears with Pilchards.

Blennius Pholes, the Shanny.

- B. Galexita*, the crested Blanney.
B. Gunnellus, the Butter Fish.
B. Phycis, Greater Forked Beard, or Hake's Dame.

ORDER III.—THORACICI.

Fishes with the ventral fins at the breast, or nearly under the pectorals. These fishes belong to the Acanthropterygii of Cuvier.

- Cepola rubescens*, red snake fish.
Gymnetrus Hawkerii, the Ceil Connin.
Gobius Aphyia, the spotted Goby.
G. Nigra, the Rock fish.
Cottus gobio, the Bull-head.
Zeus Faber, the Doree.
Pleuronectes, hippoglossus, the Holibut.
P. Rhomboides, the Kite.
P. Punctatus, the Whiff. *P. Rhombus*, the Pearl. *P. Megastoma*, the Carter or Lantern fish, or Marysole.
Chatodon, only one species.
Sparus Smaris, the Bream. Mr. Cornish says that the young of this species is the Chad.
S. Pagrus, the Becker; *S. Vetula*, the Old Wife.
S. Erythrinus, the Spanish Bream.
Labrus Tinca, the common Wrasse.
L. Bimaculatus, the bimaculated Wrasse.
L. Coquus, the Cook.
L. Gibbus, the Cork Wing.
L. Lascus, the Wrasse.
L. Luscus Suillus, the Hog Wrasse.
Perca channus, the Smooth Perch.
P. robusta, the Dusky Perch.
Sciaena labra, the Basse
Gasterosteus Ductor, the Pilot Fish. Two species only were seen; they accompanied an English ship from the Mediterranean to Falmouth.
Scomber, scomber, the Mackerel.
S. Trachurus, the Scad, *S. Glaucus*, the Albacore.
S. Maculatus, the Spanish mackerel.
Mullus surmullus, the striped Surmullet.
Trigla Lyra, the Piper.
T. Cuculus, the Elleck.
T. Gurnardus, the Grey Gurnard.

ORDER IV.—ABDOMINALES.

Fishes with ventral fins behind the pectoral ones, or on the abdomen: living chiefly in fresh waters, belonging to the Abdominal Malacopterygians of Cuvier.

- Salmo salar*, the common Salmon.
S. Trutta, the Salmon Trout.
S. Salmulus, the Palmer, or Farthing Trout.
S. Fario, the Common Trout, or Shote.
Esox belone, the Gar-pike.
E. Saurus, the Skipper.
E. Sphyræna, the Sca-pike.
Mugil cephalus, the grey Mullet.
Clupea, Herrings. Mr. Cornish states that the herrings are never absent from the coast, except for a short interval in spring, and that therefore they do not descend from the north.
C. Pilchardus, the Pilchard, constituting the object of the famous Cornwall fishery.
C. Alosa, the Spad,
C. Sprattus, the Sprat.
Cyprinus Leuciscus, the Dace.

Branchyostegous Fishes.

Cyclopterus lumpus, the Lump-Fish, belonging to the Discoboli, the third family of the Subbrachian Malacopterygians of Cuvier.

C. Cornubiensis, the Jura Sucker.

Tetraodon truncatus, the oblong Sun Fish. This species belongs to the order of Plectognathes of Cuvier.

Centriscus scolopax, the Trumpet Fish. This species belongs to Fistularido, the fifteenth family of the Acanthopterygians of Cuvier.

Chondropterygious Fishes.

Torpedo, the Torpedo, or Cramp Ray. This species belongs to the fixed gilled Chondropterygians of Cuvier.

Squalus squatina, the Angel Fish, commonly called in Cornwall the Monk Fish.

Sq. galus, The Tope Fish or White Hound.

Sq. mustelus, the Smooth Hound.

Sq. maximus, the Basking Sharp.

Sq. Cornubicus, the Porbeagle.

Accipenser sturio, the common Sturgeon.

Petromyzon cæcus, the mud Lamprey.

Trigla hirundo, the Tub-fish.

T. lyra, the Piper.

T. lineata, the streaked Gurnard.

T. cuculus, the Elleek, red Gurnard or Soldier.

T. gurnardiis, the Grey Gurnard.

Ophidium pellucidum, the pellucid Ophidium.

NATURE OF FISHES.



GENERAL DESCRIPTION OF THE NATURE AND ORGANIZATION OF FISHES. (a.)

CHAPTER I.

General Characters and Essential Nature of Fishes.

MORE than two thirds of the surface of the globe are covered with the waters of the ocean; (b) considerable portions of our islands and continents are watered by rivers of various magnitudes, or occupied by lakes, ponds, and marshes; and this empire of the waters which so extensively exceeds the amount of dry land, is far from yielding to

☞ (a) We only comply with the very judicious suggestion made to us from high quarters, in adding to this translation of the "*Regne Animal*," the admirable description of the nature and organization of fishes, as given by our immortal author in his great work "*Histoire Naturelle des Poissons*." We feel it only our duty to place before our readers, the results of anatomical researches, such as no work in the English language could supply.

(b) This assertion has been proved to be below the truth by actual examination, and as the measurements of the different portions of each element form a curious subject of contemplation, we shall not hesitate to submit them to the public.

AREAS OF THE SEAS OF THE EARTH.

	Square Miles.
The Southern, Indian, and Pacific Oceans	126,045,000
The Atlantic Ocean, and the numerous seas connected with it	33,837,000
The Caspian, Great Lakes of America, and other smaller collections of water	250,000
Area of water surface on the Earth	160,132,000

AREAS OF THE CONTINENTS, ISLANDS, &c., OF THE EARTH.

	Square Miles.
Land in Torrid Zone	13,600,000
— Southern Temperate Zone	3,560,000
— Northern ditto	17,960,000
— Polar Circle	3,520,000
— Southern	200,000

SUMMARY OF LAND AND WATER.

		38,840,000
Land		
Water		160,132,000

the latter in the number and variety of living creatures which inhabits its depths. On the land, the matter susceptible of life, is, for the most part, appropriated to the formation and support of vegetable species; the herbivorous animals are sustained upon these species, which, becoming analized by this process, constitute the proper food of the carnivorous animals, these latter, however, composing scarcely more than half the terrestrial classes of living beings. But in the waters, and in an especial manner, in the ocean, where the vegetable kingdom is infinitely more circumscribed, every thing teems with life or is ready for that condition: here the animals sustain existence only at the expense of each other, or by feeding on the mucous and other remains of animal bodies: here too may be contemplated the extremes of greatness and littleness, from the millions of monads and other species which might have been eternally invisible to us without that marvellous auxiliary, the microscope, up to those cachalots, and other whales which exceed twenty times the size of the largest terrestrial quadrupeds. Here, likewise, is it that we come to regard the grandest scale in nature of those organic combinations on which naturalists bestow the title of "classes," and of which we may well say, that they all constitute so many representatives, just as among the birds, creatures essentially aerial, we find several, as the Penguins, for example, whose structure keeps them nearly all their lives attached to the ocean tribes.

The class Mammalia numbers amongst its members in the waters not only the Seals, the Morses, and the Sea Cows, which cannot live long out of it, but also the whole of the Whales which cannot live out of it at all: whilst, at the same time, the nature of their respiratory function obliges them to come to the surface of the water. In the sea, again, we find representatives, on the part of the reptiles, in Tortoises, Crocodiles, Serpents, and especially in the Batrachian or Frog tribes. Numerous insects are aquatic, even in their perfect state; and the very considerable proportion of this class which ascends in the atmosphere to produce their young and then to die there, have previously existed in the waters, either in the larva or the nymphastate, during a large portion of their life. It is in the waters that we must expect to find almost the whole of the Mollusca, the Annelides, the Crustacea, and the Zoophytes—four classes which contribute to the land only some isolated and erratic members. Thus the ancients used to say that every thing that existed any where else was found in the sea, whilst many things were in the sea which could not be discovered in any other place. *Quicquid nascatur in parte naturæ ulla et in mari esse; præterque multa quæ nusquam alibi*.*

But of all the countless multitudes of creatures which populate and give life to the liquid element—none so abound—none are so exclusively peculiar—none so remarkable for their number, their varied forms, their beautiful colours, and, above all, the infinite benefits which man derives from them—as those which belong to the class of Fishes. This paramount importance of the fishes is such as to have led to the extension of the application of their name to every form of

* Pliny, b. IX. c. II.

aquatic animal, insomuch that in the old authors, and even in some of the writers of modern times, we frequently find this name given to Whales, to Molluscous animals, and those of the Crustacea; a sort of confusion which it is the easier to explain when we consider that the class of fishes is one of those which are most strictly limited by invariable characters.

Nothing can be more clear and exact than the definition of Fishes, in general acceptation, at present, namely, that they are vertebrated animals with red blood, breathing by branchiæ, and through the medium of water.

This definition arises from observation; it is the result of analysis, or what is called in physical science an empirical formula. But its propriety may also be demonstrated by the synthetic method, for if it be exactly comprehended, it will enable us to understand the nature of that division of beings to which the definition applies.

Vertebrated animals must, of necessity, be those which have an internal skeleton, a brain, and spinal marrow enveloped in the vertebral column (*a*), the muscles exterior to the bones, only four extremities, and the organs of the four primary senses in the head, &c.

Aquatic animals, that is to say, living in a liquid medium of greater specific gravity, and more resisting, than air; they must have their moving power exactly adjusted to accomplish progression: but elevation can be easily effected by them; hence we find them with bodies capable only of the smallest force of resistance, the principal muscular power being in the tail; hence, also, the contraction of their limbs, the expansibility of the latter, and of the membranes, by which they are supported; and hence, finally, are the integuments smooth and scaly, and altogether destitute of feathers and hairs.

Performing the process of respiration simply through the medium of water, in other words, only availing themselves of the small proportion of oxygen which is contained in the air mixed with the water, for the purpose of giving an arterial character to their blood, it follows that this blood must remain cold, and that, consequently, the vitality of the fishes, and the energy of their senses and of their motions must be inferior to those of the mammalia and the birds. And, in point of fact, their brain, though similar in its structure, is much smaller than it is in the former classes, and their external organs of sense are not of a nature to enable them to feel any very powerful sensations. The fishes, therefore, form that division of the vertebrated animals which possess the least appreciable signs of sensibility. Excluded from the use of elastic air, they are consigned to eternal dumbness, at least this is very nearly the case, and all those feelings which vocal sounds are calculated to excite, are to them for ever strangers. Their eyes have no faculty of motion, their faces are long and fixed, their limbs are incapable of flexion, and always moving in one single mass, afford no opportunity for the play of their physiognomy, and no power for the expression of their emotions; their ear enclosed on every side in

(*a*) To guard against any misunderstanding with respect to the assertion that the brain is in the vertebral column, we must mention that the skull is regarded as only a vertebra extensively developed.—ENG. ED.

the bones of the head, destitute of an external concha, as also of a cochlea internally, and composed solely of little sacs and membranous canals, hardly enable them to hear the loudest sounds. Of little use would the faculty of hearing be to these animals, that are condemned to live in the realms of silence, where all about them is still. Vision would be of little advantage to fishes in the depths to which they are consigned, had not most of the species, in the large proportion of their eyes, a resource against the weakness of the light; but in these animals, the direction of the eye is hardly ever changed, and still less can they vary its dimensions so as to accommodate the organ to the distance of visible objects. The iris neither contracts nor dilates, and the pupil is never altered whatever be the diversity of the quantity of light. No tear bathes that eye, no eye-lid dries or affords it protection, and in the fishes there is only found a very feeble image indeed of that organ so remarkable for its beauty and its animation in the higher classes of animals. They procure their food only by swimming in pursuit of their prey, which itself swims with greater or less rapidity, they possess the power, not indeed of seizing, but merely of swallowing, so that the delicate faculty of taste would have been thrown away upon them had nature bestowed it; but their tongue, almost immovable, sometimes completely bony, or, like a coat of mail, studded with plates of teeth, and supplied very sparingly with thin nerves, demonstrate to us that the organ is just as blunt as we should have previously concluded from its very little use. The function of smell, also, cannot be so continually exercised by fishes, as it is by animals which breathe the air, and through whose organs of smell odoriferous vapours are constantly circulating. Lastly, their touch, almost obliterated at the surface of the body by the scales, and also in their limbs, in consequence of the absence of the power of bending their rays, and, further, in consequence of the dryness of their enveloping membranes, their touch, I repeat, has been forced, as it were, to take refuge at the extremity of their lips, and these even, in some species, are reduced to a state of bony hardness, that renders them insensible. Thus, the external senses of fishes supply them with a very small share indeed of lively and distinct impressions; the natural objects which surround them must affect them only in a confused manner; but little variety belongs to their pleasures, and no sufferings are likely to visit them from without, save such as may be the effect of wounds. Their unceasing craving, that which alone influences and acts on them, except during the nuptial season, that predominant passion must be enough to satiate their internal sense of hunger; to devour is almost the entire business of their lives when not engaged in reproducing, and it is solely for this great purpose, feeding, that their structure is adjusted, and all their organs of motion arranged. To pursue their prey, or to escape an enemy, is the double employment of their existence; it is these that determine the various habitations of which they make choice, and the variations of their forms; they also serve to explain why nature supplied some of the species with so few instincts, and so little of any faculty of contrivance; the fishing rays of the anglers*, the tubed-mouths sud-

* See p. 158 of this volume. See *Epibulus* and *Coricus*, in the 14th family of the same order

denly shot out of the *Epibulus* and of *Coricus*, the terrible commotion excited by the *Torpedo* and *Gymnotus*, have no other object. The variations of temperature themselves affect fishes very little, not only because these changes are more limited in the element where they reside than in our atmosphere, but also because their bodies, assuming the surrounding temperature, the contrast between the external cold and interior heat is hardly felt by them. Thus, the seasons are by no means, in respect of the migrations or epochs of propagation, such strict regulators of the fishes as they are of the quadrupeds, and especially of the birds. Many fishes spawn in winter; towards autumn the herrings come down from the north to shed their milts and roes on our coasts; it is in the north that this class exhibits the most astonishing fecundity, if not in the variety of the species, certainly in the number of the individuals composing each species, and in no other part of the sea, besides, do we find any thing even approaching to the infinite myriads of cod and herrings which periodically attract entire fleets into the North Seas.

The nuptial intercourse of the fishes is as frigid as they are themselves; it involves only an individual want. Some species hardly ever come together mutually to enjoy pleasure; in other species the males pursue the roe rather than the female; and they are reduced to the condition of fecundating the roes of the mother of whose they are utterly ignorant, and the mature state of whose productions they shall never become acquainted with. The pleasures, therefore, of a mother are denied to a great number of the species; several merely carry the roe for a time, and, with some exceptions, the fishes may be described as having no nest to build, no young to support and protect; in a word, throughout the whole details of their economy a complete contrast with the birds is presented by the fishes.

The being of the air beholds before him a magnificent horizon; his acute organ of hearing enables him to appreciate sounds and intonations, and, by his voice, he may produce them again; should his bill be hard, and should his body be clothed in down for his protection, when he ascends to the elevated regions of the atmosphere, then shall he find in his feet the very perfection of the most delicate sense of touch. In the enjoyment of all the sweets of conjugal and paternal affection, he courageously fulfils the duties which these characters impose on him, he defends himself and his offspring; a wonderful art presides over the construction of the nest, and when the proper time arrives, they labour together without interruption. During the interval, whilst the mother is hatching the eggs with such admirable constancy, the father, impassioned of his lover and become a tender husband, beguiles the fatigue of his companion with his minstrelsy. Even in a state of slavery the bird attaches himself to his master; submitting to him and executing under his orders the most dexterous and delicate exploits, he hunts like a dog, and suits his voice to the highest airs, nor is it without a feeling of pain almost that we deny to him the possession of reason.

The inhabitant of the waters, on the contrary, has no attachment; without language, without affection, he knows not what it is to be a husband and a father, or what it is to have a home; when danger

threatens he hides himself beneath the rocks in the sea, or darts rapidly down into the depths of the water : his life is a monotonous stillness ; his voracity alone constitutes the business of his life, and it is only by that that he can be led to direct his motions through the medium of signs from without. Nevertheless, these beings to which enjoyments have been so scantily supplied, are decorated by nature with every sort of beauty : variety in their forms, elegance in their proportions, diversity and gaiety in their colours,—nothing, in fact, is wanted in them to fix the attention ; and it really would seem that nature had this end in view in her design. The splendour of the metallic bodies and of all the precious stones, with which they shine forth, the colours of the iris which they exhibit, are reflected in bands or spots, in undulating or angular lines, but invariably regular and symmetrical, the shades wonderfully adjusted and contrasted. Wherefore should all these endowments be distributed to creatures like the fishes which scarcely ever see each other, save only in those depths where the light of the sun hardly penetrates, and even when they do see each other what sort of pleasurable sensation can be excited amongst them by these characters ?

Hence it is that man has always directed his attention to the animals of this class. The abundance of aliment of which they are the source leads him to attack them as the first object of his pursuit ; and many Ichthyophagi belong to a race less inferior in the scale of civilization than even the pastoral tribes, and great numbers of families derive the whole of their subsistence from fishing. Islanders and residents on coasts look after and take notice of the numerous species which frequent their rocks, and a more intrepid race actually navigates to the greatest distance, to attack, in the middle of the ocean, the huge phalanxes of fishes travelling on their course. But in thus supplying the first necessities of man, the fishes are not the less available to the opulent, as means of luxury the most refined. Rome, the gulf into which were once poured the riches of the world, devoted to this branch of expenditure sums such as now we can scarcely believe. Ponds of immense size were maintained both for sea and fresh water fishes ; they were actually brought alive on the table, to afford amusement by the variations of colour which they experienced in dying ;* and it would appear that such were the pains and perse-

* “ *Mullum expirantem versicolori quadam et numerosa varietate spectari, proceres gulæ narrant, rubentium squamarum multiplici mutatione pallescentem, utique si vitro spectetur inclusus.*” (Plin., I. IX, c. 17. Voyez aussi Sénèque, *Quest nat.*, I. III, c. 18.

Et

*Ingeniosa gula est, siculo scarus æquore mersus
Ad mensam vivus perducitur.*

(Petron. *Carm. de bello civ.* v. 33.)

Translation.—“The belly-gods of former times tell us that the mullet in dying, underwent a very great variety of changes of colour ; becoming gradually pale by very rapid changes of the red colour of the scales, precisely as if it were enclosed in glass.” (Pliny I. IX, c. 17.) See also Seneca, *Quest. Nat.* I. III, c. 18.

And,

“Gluttony is ingenious, for the scarus fish which is merged in the Sicilian sea, is brought alive to table.” (Petronius, *carm. de bello civil.* v. 33.

verance adopted in the treatment of fishes, that an infinitely more extensive command was acquired over them than we should have at all supposed possible from their nature. Some fishes used to recognize their masters, and even had names by which they came at a call; at least this is what has been handed down to us by authors, who speak of the fishes as perfectly astonishing productions of industry stimulated by luxury.*

It is from observations made in fish-ponds, and from information collected by fishermen during their expeditions, that we derive the little which we know of the manners of these animals; but it is very probable that most of their secret habits utterly escape our knowledge in those depths where they pass the greater portion of their lives. Some live solitary, others in troops; one set traverses immense spaces, whilst others, always sedentary, never leave the bottom where they were born. The nature of the bottom too, determines the habitation of several of the species. There are fishes that live only in the rocky parts of the sea coast; others will prefer the pure waters of the high seas, others again will choose the stagnant and muddy waters, where they can bury themselves in the mud or the sand, and of these there are several that can live, even when the mud or sand by which they are

* Martial., l. IV, ép. 30, v. 3 :

*Sacris piscibus hæ natantur undæ
Qui norunt dominum manumque lambunt,
Illam qua nihil est in orbe majus.
Quid quod nomen habent et ad magistri
Vocem quisque sui venit citatus.*

Et l. X, ép. 30 :

*Piscina rhombum pascit et lupos vernas.
Natat ad magistrum delicata muræna.
Nomenclator mugilem citat notum
Et adesse jussi prodeunt senes mulii.*

Plinne rapporte le même fait, l. X, c. 70 :

“Spectatur et in piscinis cæsaris, genera piscium ad nomen venire, quosdamque singulos.”

The passage in Latin quoted, is from the Roman poet Martial, and the epigram instead of being the 30th, is really the 23rd. in the 4th book. The extract is made from an epigram addressed by Martial to all anglers, not to go near a royal pond at Balizæ, belonging to the Emperor Domitian; the word “hand” in the following translation refers to that of Domitian.

Martial, l. IV. ep. 30, v. 3.

These waters are swimm'd by sacred fishes,
Which know their ruler, and lick that
hand than which in the world is greater,
Whatever be the name they have, each comes
at the call of the master of the pond.

And l. X, ep. 30.

The pond feeds the turbot, and welves feed slaves,
The delicate muræna swims to his master.
The collector of names summons the known mullet,
And the old ones come out when ordered.

Pliny states the same fact, l. X, c. 70.

“It may be seen in Cæsar’s pond, each fish comes as his name is called.”

enveloped is no longer covered with water, subsisting on the smallest portion of that fluid which it may contain. The immobility of some fishes as the Rays, and those of the genus *Lophius*, forms a striking contrast with the very great rapidity of a large number, especially some of the mackerels. Several fishes as the Eels and Gobies can actually live for some time on dry land, and can creep on the banks of rivers; the anabas climbs up trees, and establishes himself on the leaves where little collections of water are formed. The pirabebès and flying fishes have such extensive pectoral fins as to enable them to rise and support themselves in the air, and even to move a good distance in it. The most remarkable industry in all the class perhaps, is that of certain fishes of India, *Toxotes jaculator*, and *Chætodon rostratus*, which, by spurning drops of water to a certain height, bring down insects for their food. But all these varieties of habits are principally connected with the conformations of the animals, and it would be in vain to attempt to give an account, unless from a detailed study of the structure in every part of the body, of the distinctions which mark it from that of the other Vertebræ, and the modifications of it in the various families, genera and species.

It is for this study that the whole of this book is destined to be a preparation. We begin it by an examination of the body of the fish in its exterior; we then describe the bony frame work which supports and gives it form and proportions; the muscles which act on it and supply it with the due impulse for its various motions: then the organs of the senses which receive the impressions of external objects; the nerves which convey these impressions; the brain where they ultimately meet, and from which the commands of the will are distributed: next the organs of digestion, beginning with the teeth, and ending with the lacteals which carry the chyle into the blood: the vessels of the circulation, both those which carry back the blood from the various parts of the body to the gills, or from the gills to the various parts of the body; then these gills themselves with all their appendages, or the means whereby the blood receives, from without, the portion of oxygen which is essential to it: finally, we shall describe the organs of reproduction in the two sexes, and the roe or the various envelopes and provisions prepared for the foetus.

It is only after we have been acquainted by the succeeding articles, with the general notions of all the parts of animal organization, such as it is found modified in the fishes, that we shall be able to take up, with advantage, the particular history of families, genera, and species.

In our descriptions we shall be as brief as the necessity of preserving clearness will allow; we shall avoid, most carefully, that jumble of technical terms, which seem invented on purpose to make as repugnant as possible a science already overgrown with intrinsic difficulties, and which are very little necessary to the description of beings and forms, generally speaking, so simple as the fishes.

CHAPTER II.

EXTERIOR OF FISHES.

THE fishes, having no neck, and their tail at its commencement being generally as large as the trunk, their body is most commonly of a shape that only diminishes very gradually towards each of the extremities, unless one or the other should be truncated or ended in a club, or the tail (as occurs only in the rays) be much more slender than the rest.

The body is either rounded, as in the Diodons, or cylindrical as in the Eels; it is compressed either horizontally as in the Rays, or vertically as in the greater number of fishes.

The head is either bulkier than the body, as in the genus *Lophius*, or smaller, as is the case in many species; it is round or compressed in various directions; it is obtuse as in the Bull-heads (*Cottus*), or more or less elongated as in the Flute Mouths (*Fistularia*), or the genus *Centricus*. There are fishes with the two jaws prolonged into a beak as in the Gar Fish (*Belone*), and some with only the lower jaw prolonged, as the subgenus *Hemiramphus*; or sometimes the upper jaw forms a snout projecting over the mouth as in the Rays, the Sharks, and the Sword Fish.

The mouth opens either beneath the snout as in the Rays, or at its end as in the greater part of fishes; it may open even vertically towards the heavens as is the case with the Star Gazers (*Uranoscopus*); its cleft is more or less extensive, varying from the size of a small hole as in *Centricus*, to that of a vast mouth as in *Lophius*.

Externally we only find the organs of two senses, the orifices of the nostrils and the eyes; the first are either very simple as in the Rays and Sharks, or they are double as in the greater part of osseous fishes: they may be more or less approximated either from the jaws, from the eyes, or the end of the snout.

The eyes vary extremely in size according to species, and they even disappear occasionally under the skin, as in the Ribband Fishes (*Taenioides*): their direction is not less variable than their diameter; they are most frequently directed laterally, and are elevated sometimes so much, as to be completely vertical and turned to the heavens, as in the Uranoscopes; in the whole of the Flat Fishes (*Pleuronectes*), they are both on the same side of the head, the right or left.

There is only one family of fishes belonging to the Chondropterygians, with the outer borders of the branchiæ attached to the skin, and with as many openings for the issue of water as there are intervening spaces between the branchiæ; but all the other fishes of this order have the branchiæ free at the external border; and the water which they imbibe makes its exit by a single opening (a solitary gill) on either side. This gill varies considerably in size and in the extent of

its aperture ; in the Herrings it is enormous, and is continued round the whole side of the head : in the Eels it is rather small, and placed backwards ; some species of this family, the Synbranchiæ, have no more than one opening for the two gills.

The operculum, which, by its motion, is an agent in respiration, varies both in its size and shape : the membrane which completes it beneath, is joined either wholly or partially to its fellow of the opposite side, or to that portion of it which is adjacent to the shoulder. The number of rays which support it is more or less considerable ; some times as in the Tetrodons, the Diodons, and the Ostracions, a large portion of this apparatus is concealed beneath the skin, and it can only be seen by dissection ; it is altogether wanting in those small species which have numerous orifices.

A part of the fins are vertical, and become to the fish what the keel or rudder is to the ship ; they are fixed either to the back, when they are called *Dorsal*, or beneath the tail when they are called *Anal*, or at the end of the tail when they are called *Caudal* ; they vary in the number, in the height, and in the structure of the rays which support them, and which, in some cases, are spinous, and in others, branched and composed of many small joints. Other fins are arranged in pairs, and represent the four extremities of the higher classes. Those fins which correspond with the arms and wings, are called *pectoral fins*, being always attached behind the gills ; the fins which answer to the feet are called *ventral fins*, and may be placed more or less forward or behind, from the lower part of the throat to the origin of the tail. Both the fins are variable in their size respectively, in the number of their rays, in the circumstance of their being a simple or a jointed structure. Sometimes one of the pairs, sometimes the two pairs are altogether wanted ; the Eels, for example, have no ventral fins, and the *Muraena* not only have no ventral, but they have no pectoral fins : the *Apterichtes* have no fin at all.

We call those osseous fishes, the rays of whose fins are articulated or jointed, *MALACOPTERYGIANS* ; and the name of *Acanthopterygians* is given to those fishes which have the fins partly simple, and in the form of spines ; but in some Malacopterygians, as the Carps and Siluridæ, the soldering of the articulations gives to certain of the rays, the appearance of spines. The anus is sometimes very far back behind the ventral fins ; it approaches them in some fishes or gets before them, and when the fins do not exist at all, it is found to have its opening just under the throat, as may be seen in the *Sternarchus*. In certain species, as the Gobies and Blennies, the anus has, behind it, a tongue-like body which would appear to have something to do with generation, but it cannot be a penis, inasmuch as it is common to the two sexes ; it is not to be found, however, in the greater number of other fishes.

The whole of the distinctions to which we have now been adverting, belong to the intimate structure, to the frame-work of the fishes ; there are other distinctions of a more superficial kind.

The jaws are armed with teeth of all sorts, and these are sometimes placed in all parts of the mouth and even in the gullet.

The lips are furnished with appendices or cirri, which differ either

in their texture, their number and length, as in the Barbels, Silures, and the Pogonias.

Some fishes have thick fleshy cirri on the body as the Scorpœnas ; some of the rays can be detached from the fin, and are capable of independent motion, whether they belong to the vertical fins as in the genus Lophius, or to the pectoral fins as in the Gurnards.

In fine, the nature of the integuments, whether we speak of those of the body, or of the head, or the fins, is subject to variety ; a fish may be either naked, scaly, spinous, or mailed, in all or only in some of its parts ; its scales, or the pieces of its coat of mail, differ very considerably in size, in outline, in the indentations of their borders, and the inequalities of their surface. The same may be said of the various pieces which cover the head. The line, formed on each side of the body by a series of pores or minute tubes excavated in the scales, are sometimes more or less marked, or even mailed and protected ; again, it is more or less straight, or more or less brought nearer the back. If we combine, with all these considerations, what belongs to the colours, the distribution of those colours and their shadings, and further, what belongs to the size and weight of fish, we shall be able to form some idea of the character which distinguishes, externally, the various beings of this great class. We shall, at the same time, be struck with the inadequacy of ordinary language to express and convey a just impression of all these diversities.

CHAPTER III.

OSTEOLOGY OF FISHES.

After the above general exposition, we proceed to the examination of the various organs, and we shall begin with those which are the support of all the others, namely, those composing the skeleton ; but before we take up the several bones, it is necessary that we should have some previous knowledge of their peculiar nature and their intimate tissue.

Tissue of the Bones in Fishes.

With respect to the tissue of their bones, fishes may be divided into the Osseous, Fibro-cartilaginous and True Cartilaginous fishes.

The last of the divisions, also denominated in former times Chondropterygians, and which from their frame-work, their branchiæ, (the external edge of which, on each side is, attached to the skin, and through which the water escapes only by means of very small but numerous orifices,) and on account of many other peculiarities of their organization, are distinguished, very strikingly, from all other fishes, —the fishes of this division, we say being not furnished with true bones. The hard parts of their frame consist internally only of cartilage which is homogeneous and semi-transparent, which is developed on the surface of the Rays and Dog-fishes only, in a layer of minute, opaque, and

calcareous particles arranged in a very compact manner : but this cartilage in the Lampreys never assumes this form of the covering, and in the common Pride (*cammocœtes*) it continues always to be nearly membranous.

The Sturgeon and Chimæra have, to a certain extent, the same sort of softness of their spine as the Lampreys; but the former genus has many more bones in its head and shoulder, (at least one lamina of their surface) perfectly hardened and bony.

The other fishes present scarcely any other difference between them except the hardness of the pieces composing their skeleton; and it is rather unfortunate that the fibro-cartilaginous group should have been associated with the Chondropterygians by some naturalists. The calcareous matter,—in other words, the phosphate of lime, is deposited in the former, either in fibres, or in layers in the cartilage, which constitutes the basis of their bones, just as it does in the most osseous of the fishes. The only thing is, that it is less abundant in them, and the tissue of the bone does not become so hard, neither does it assume that homogeneity which characterizes the bones of certain osseous fishes.

As an example we may mention the Moon-fish (*tetrodon mola*) in which we find some fibres, sprinkled, so to speak, over the membranes. *Lophius piscatorius* is the fish that approaches the Moon-fish most in softness. The other tetrodons, diodons, file-fishes, and ostracions, have their bones both harder and more homogeneous, so that they are distinguished from the real osseous fishes with very great difficulty.

It is also perfectly certain that the bony frame work of these fibro-cartilaginous fishes is constructed on the same plan as that of the osseous fishes, and not on that of the chondropterygians, and it is altogether in opposition to truth for both Artedi and Linnæus to deny to these fishes both the opercula, and the branchiostegal rays: the file-fishes have true ribs which are wanted in the tetrodons, the diodons, and ostracions; the real difference between the three genera being the arrangement of their jaws respectively. The pipe-fishes (*syngnathus*) have not even this difference, but then they are deficient in the ribs, and in the branchiostegal rays.

A perfectly gratuitous assumption has been entertained as to the bones of ordinary or osseous fishes being more flexible and extensible, becomes a softer skeleton than the classes above them, and it has been attempted to found on this doctrine a theory which pretends to explain the longevity observed in some species. Now, most of the osseous fishes actually have their bones quite as hard, nay, harder than other animals; there are even some, in whose tissue we can discover neither pores nor fibres, and which look perfectly homogeneous and with a glassy polish to the eye.

No fish whatever, either of the osseous or cartilaginous orders, has epiphyses or medullary cavities in their bones; but in some of these animals, as the Trouts, the bony tissue is penetrated with a variable quantity of oleaginous juice. Others, as the Dory, have the internal parts of particular bones permanently cartilaginous, whilst the surfaces of these bones are completely ossified. In fine, we see

fishes, in which, whilst the rest of the skeleton is increasing in hardness, some part or another is sure to remain cartilaginous, and this is really exemplified in the head of the Pike.

The Joints of the Bones of Fishes.

The articulations, or joints, of fishes, exhibit the same varieties as are observed in those of other animals, save only, that those of the arthrodial and ginglymus kind, or whose articulations which allow of determined motions, either according to a single plan or to many, are rarely to be found in the fishes, inasmuch, as their limbs are not required to perform any varied series of motions. (a) It is by means of a ginglymus, for instance, that the lower jaw and the operculum are attached to the pterygo-palatine apparatus, and the latter to the cranium. We observe it also in the joints of the rays of the dorsal and anal fins formed with the interosseous bones, and in the joint of the first ray of the pectoral fin with the bone, which in the fish, analogous to the radius. (b) In the fishes there are two species of joints for a given extent of motion, of which we have no instance in any other class: we allude to the rings which are joined to each other like the links of a chain, and which, according to the impulse given them by the fish, become very active or completely fixed; examples of the one kind and the other, are to be met with in the Silures. The joints, destined for a certain extent of motion, like those of the superior animals, have their ligaments, cartilages, and synovia. (c)

The articulation of the bodies of the vertebræ is formed by means of a fibro-cartilaginous substance passing through these bodies, and sometimes assumes the form of an elongated cord, as in the sturgeon and lamprey; it is also by a medium of fibro-cartilage that the pieces of the opercula, those of the branchial apparatus, those of the bones of the shoulder, arms, wrist, bones of the pelvis, and of those which are attached to the bones of the shoulder, become united, the one to the other.

Chemical Composition of the Bones of Fishes.

From the investigations and experiments which my learned colleague in the Institute, M. Chevreul, has gone through, on my entreaty, it appears that the bones of fishes, as well as those of other vertebrated animals, consist of an organic base (animal matter) penetrated by an earthy substance.

☞ (a) It may be proper to state, that the Arthrodia or Arthrodial class of joints consists of those in which flat surfaces, or nearly so, are connected. The wrist joint is an example of this class. The ginglymus division of joints consists of those resembling a hinge, as the elbow for instance.

(b) The radius is the bone which may be felt in a line with the thumb, up to a point opposite the elbow.

(c) This word is of Greek origin, and means the resemblance to the white of egg. Synovia is an oily albuminous fluid, secreted in membranes between the joints, and operates precisely as grease on the wheels of vehicles.—ENG. ED.

The earthy substance is phosphate of lime and magnesia, together with oxide of iron, which is supposed to be combined with phosphoric acid; there is also a slight quantity of sub-carbonate of lime. The animal matter is of two kinds; one is of the character of nitrogen or azote, and it is the basis of cartilage; the other, of a fatty nature, is a sort of oil by which it is impregnated.

The cartilage of the bones of fishes differs much from that of the mammalia and birds, for it yields when boiled in water, no gelatine whatever.

The oil consists of a large proportion of oleine, to which are added in very minute quantities two principles, one of which is odorous, and the other a yellow colouring matter. The oil is changed into soap with great facility, and when so treated gives off oleic acid, glycerine, and a very minute quantity of margaric acid, so that, if this acid be supplied by stearine contained in the oil, the stearine cannot certainly exist in any great quantity in the oil.

The bones of a carp and a perch having been placed in a vacuum, and dried until they were incapable of yielding no more water, sustained a loss of their original weight equal to eighty-seven centimes. In one hundred parts the following components were found :

Cartilaginous azotic matter	36	5
Oil chiefly consisting of oleine	19	5
Phosphate of lime	37	
Sub-carbonate of lime	5	5
Phosphate of magnesia and oxide of iron	0	7
Sub-carbonate of soda, sulphate of soda, and chloride of soda, (sea salt)	0	8
Total	100	

In the cartilaginous fishes, or chondropterygians, there is a greater proportion of water. The comparative quantity of soluble salts, that is, of the chloride of soda, sub-carbonate of soda, and especially of the sulphate of soda, is much greater, whilst on the contrary the proportion of the phosphates is considerably less; but their animal matter is the same in the azotic substance and the oil. The vertebræ of the Pilgrim *Squalus maximus*, analyzed when it was fresh, yielded in one hundred parts,

Water	90	0
Azotic matter of cartilage and oil	6	485
Sulphate of soda	1	859
Chloride of soda	1	362
Subcarbonate of soda	0	2
Phosphate of lime and magnesia; oxide of iron, of alumina, and silicum	0	094
Total	100	

The analysis of the same bones when dry, gives the following results.

Azotic matter and oil	64	85
Sulphate of soda	18	59
Chloride of soda	13	62
Subcarbonate of soda	2	
Phosphate of lime, &c.	0	94
		<hr/>
Total	100	

M. Chevreul is of opinion that the soluble salts are not in their solid state in these cartilages, but in a state of solution in the water, and what is very remarkable still is, that the liquid found in the intervertebral cavities of this squalus has only slight traces of the sulphate of soda, whilst its cartilage consists of so large a quantity of that substance. This liquid, in addition, contains chloride of soda, subcarbonate of soda, and a very small proportion of oil, and the azotic substance of cartilage.

*General Arrangement of the Skeleton in Osseous Fishes.**

In this place we shall consider the skeleton in those species, in which it assumes its most general form, viz., the Osseous Fishes, postponing to another opportunity, the examination of those peculiarities by which the Chondropterygians are distinguished.

This skeleton consists of the head, the respiratory apparatus, of which the osseous frame-work is very much developed, of a trunk, which comprehends the body and tail; and by the limbs, which are the pec-

* The osteology of fishes has been a long time neglected. There is not a single skeleton of a fish in the collections of Blasius or Valentin. Cheselden has given a plate of the skeleton of a Ray, but without any description (1). Duhamel has given another, that of the Flounder (3). Bonnaterre has added the skeleton of a Carp (4). The author who gave the greatest number of plates of fishes in the last century, was John Daniel Meyer, who published the figures of twenty-four species (5). The descriptions of all these authors, however, are quite vague and unsatisfactory (5). The same character may be given to the sort of ideal form offered by Gouan (6), with a description full of errors both of omission and commission; and as to what Vieq-d'Azir has stated respecting them in his Memoirs on Fishes, it is hardly complete (7). It was only in 1800 that the subject began to be treated in a true scientific manner by M. Anteriorieth (8). From that era we have had the various Memoirs of M. Geoffroy in the *Annales et Memoires du Museum*, and in his large Description of Egypt, which have illustrated many parts of this science (9); we may add the work of M. Schulze in the German Archives of Physiology by Meckel (10), where several good observations will be found. But the most recent *ex professo* work on this subject is the Memoir of M. Rosenthal, inserted in the Physiological Archives of Reil (11), and the publication of which was followed, and its character supported, by several fasciculi of plates, in which very accurate figures of the skeletons of a great number of fishes are given (12). Excellent summaries on this branch will be found in the Thesis of M. Van-der Hæven, *De Sceletio Piscium*, Leyden, 1822, in 8vo, and in the *Osteographia Piscium* of M. Bakker, printed the same year at Groningen. M. Meckel has also contributed a very elaborate and well executed summary, enriched with many original observations in his *Comparative Anatomy*, lib. 2, p. 17—381, published in 1824. By and bye we shall refer to works which

oral and ventral fins: the vertical fins (that is the dorsal), the anal and caudal must be considered as part of the trunk.

The head, with a greater number of moveable parts than is found in the Mammalia, requires to be subdivided into a great many regions. We distinguish in it, the cranium, the jaws, the bones situated beneath the cranium and behind the jaws, and which serve to suspend them and give them power of motion, the bones of the opercula, or the sort of lids which open and close the aperture of the gills; the bones which are nearly external that surround the nostril, the eye, or the temple, or which cover a portion of the cheek.

The respiratory apparatus contains the os hyoides and its appendages, or in other words, the branchiostegal rays, and the arches which support the gills, with the different pieces borne by these arches, or which are suspended in them; the whole of these in combination perform the functions of both larynx and trachea; lastly, it

are expressly devoted to the head of Fishes. It will not be necessary for us to make use of the figures of these authors in our descriptions, as we have all the skeletons which they have communicated, and a great many others which now have accumulated to nearly a thousand.

Notes to the foregoing note.—(1). It is the tail-piece of his preface to the work on Osteography. (2) *Pêches*, 2d part, sect. 9, pl. 7. (3) *Ibid.* p. 12. (4) *Encyclopedia Methodique*, plates of Ichthyology, pl. A. (5) In his *Representations of Animals and their Skeletons*, printed at Nuremberg, 1748, 2 vols. folio. In vol. 1, pl. 7, may be seen the *Carp*; pl. 8, the *Mirror Carp*; pl. 9, the *Pike*; pl. 42, the *common Eel*; pl. 43, the *Orfe*; pl. 44, the *Trout*; pl. 71, the *Ling*; pl. 72, the *Bream*; pl. 73, the *Perch*; pl. 74, the *Gudgeon* and *Loche*: vol. 2, pl. 10, the *Barbel*; pl. 11, the *Nase*; pl. 12, *Cottus Gobio*; pl. 15, the *Tench*; pl. 52, *Salmo Thymallus*; pl. 53, *Cyprinus Erythroptalmus*; pl. 4, *Cyp. Carassius*; pl. 92, *Cyp. Dobula*; pl. 93, *Cyp. jesus*; pl. 94, *White Orfe*; pl. 95, *Cobitis Fossilis*; pl. 96, *Cob. Tania* and *Cyp. Phoninus*; pl. 97, *Cyprinus Leuciscus*. (6) *Histoire des Poissons*, p. 58, and sec. pl. 2. (7) In the *Memoirs of the Academy of Sciences*, foreign naturalists, vol. vii., and in his *Collected Works*, by M. Meroan of La Sarthe, vol. v. (8) *Archives Zoologiques et Zootimiqu* Wiedemann, vol. i. 2d no. p. 47. (9) *Annales*, vol. ix., on the bones of the shoulder and the furcular bone (thecoracoid); vol. x. on the sternum (the os hyoides); *Memoirs* vol. x. on the Vertebra; *Description of Egypt*, *Natural History of Fishes*, pl. 2, the skeleton of a *tetrodon*; pl. 3, that of a *Bichir*. We shall speak in a future page of his labours on the head. (10) Vol. iv., 1818, p. 340, and seq. (11) Vol. vii. p. 340, et seq. (12) First no., Berlin, 1812, pl. 1, the *Bream*; pl. 4, the *Herring*; 2d no. ib. 1816, pl. 5, *Salmo Marraë*; pl. 6, the *Salmon* and *Serra-salmon*; pl. 7, the *Pike*; pl. 8, the head of the *Gar Fish*; pl. 9, the *Silurus*; pl. 10, *Cobitis Fossilis*, *Centrisens Scolepa*; 3d no. ib. 1821, pl. 11, the *Flounder* and *Pleuronectes Mancus*; pl. 12, *Sparus Raii*, *Coryphona*, *Novacula*, and *Balistes Branbensis*; pl. 13, *Zeus Faber*, *Chatodon Cornutus* and *Striatus*, and a pretended *Coryphona Lutea*. 4th no. ib. 1822, pl. 14, *Sparus uciandra*, Rudolph. which is a *Cantharus*, the *Anabas* (*Perca Scandens*, Daldorf, the *Paneiri* or *Tree Climber* of Tamoul); pl. 15, a *Labrus*, which the aucalls *Fuscus*, and the *Phycis Tinea* (*Blennius Phycis*, Bl.); pl. 16, *Polyprion Cernium*, improperly designated *Sciæna Aquila*; pl. 17, the *Corb*, called *Sciæna Umbra*, the *Scomber Sarda* and *Scoræna Scrofa*; pl. 18, *Trigla Hirundo*, *Uranoscopus Scaber*, the head of *Trigla Cataphracta*; pl. 19, the *Blennius Ocellaris*, *Lophius Histcio*; pl. 20, the *Remora*, the *Black Goby*, and *Lepadogaster Balbis* of Risso.

embraces the bones situated at the orifice of the pharynx, and which constitute in some respect secondary jaws.

The trunk is formed of dorsal and caudal vertebræ, (for we can hardly speak of the existence of a neck, and it is quite certain that there is no sacrum in fishes) of ribs, bones called interspinous, which afford a support for the dorsal and anal fins, and to the rays of the fins, as well as to those of the caudal. Such of the rays as have branches and joints, or are simple spines, become divided into two equal portions in the direction of their length.

A sternum, properly so called, is very rarely found in fishes, and when it does exist in a species, it is composed of two pieces which are almost exterior, and on which the inferior extremities of the ribs are united.

The anterior limb, or the pectoral fin, consists of the shoulder, of a bony half-girdle, composed of several bones, suspended at the top of the cranium or spine, and uniting with each other beneath. These bones are analogous to the two pieces of the scapula in reptiles, to the humerus and bones of the fore arm. Generally, there is a stylet of two pieces, in which the coracoid, and even the clavicle, may be detected. But what is beyond all doubt is, that the two bones which represent the ulna and radius, have on their edges a series of very small bones, which appear to be the rudiments of those of the Carp, and which do actually support the rays of the pectoral fin.


The posterior limb, which varies a great deal more in its position than in the mammalia, and the exterior and moveable portion of which is called the ventral fin, is directed sometimes forward, at other times downward, and also appears behind the anterior limb; it is composed of four bones, the largest of which, and they are the most permanent likewise, being uniformly before the anus and orifices of generation, may be regarded as a sort of pubis; they support on their anterior edge, the rays of the fin without intermediate small bones, which cannot be compared either to a femur, or tibia, a fibula, or even to the bones of the tarsus.

The rays of the pairs of fins are longitudinally divided into halves as the vertical fins.

After this general description of the parts into which the skeleton is divided, we proceed to their individual examination.

The Skeleton and the Head.

The cranium of fishes is in general more distinct, it is more separated from their face than that of any other of the vertebrated animals. In a vast proportion of the species, the intermaxillary and maxillary bones have a motion on the cranium by diarthrosis(*a*), and are independent of each other in their motions, nay, independent even of the

 (*a*) This word means the sort of joint or articulation, in which two bones are not joined or immovable, but which are kept contiguous by ligaments, and have motion.—ENG. ED.

palatine, pterygoid, and tympanal system, which has its separate motion*.

* The history of researches on the bones of the head in fishes is entirely recent, and can be traced scarcely to twenty years back. Gouan, in his History of Fishes, in 1770, and Vicq. D'Azyr, in his Memoirs on their Anatomy (Memoires des Sav. Etrang. vol. VII,) mention nothing respecting the bones of the head, except what is very vague, and occasionally erroneous. There were no more than a few insignificant words on the composition of the cranium in this class, in my Lectures on Comparative Anatomy up to 1798. What was said there gave very little details of the bones of the face; and it was also very imperfect, for the sphenoid was compared to the vomer, the maxillary bone to the zygoma, &c.

In fact, at that period our collections were destitute of almost every sort of aid towards the osteology of this class, and it was this circumstance that led me to devote myself uninterruptedly to the task of filling up this great gap. The innumerable specimens which I have collected, and the use of which I never denied to any one, formed at the same time the groundwork for the laborious undertaking which I am now presenting to the public, and for the memoirs of several naturalists, who therefore might easily appear to have anticipated me; and, if they had anticipated me on some particular points, still I am far from complaining of publications and researches made with my consent, and which have been of use to me. The only thing I was anxious about was that those whom I allowed to take the benefit of the materials which I had collected for the purpose of filling up the gaps in my first work, would have abstained from selecting that early performance for their criticisms, thus leaving it to be inferred that I was stationary at this point of my researches.

About the year 1807, M. Geoffroy, in addition to his Memoir on the Osteology of the Head of the Crocodile, inserted in vol. X. of the Annales du Museum, published some essays to determine the bones of the head in the tortoise and some fishes; and it was at that time that he entertained the idea of the operculum being a parietal bone, and emanating from the cranium. This theory was published by him in his Memoir on the Bones and Head of Birds, which was printed in the same volume, X, p. 342.

I was led myself also to examine the head of the crocodile, and gave, in the Annals of 1808, my osteology of living crocodiles and other reptiles. But since that period I have been devoted to my large Treatise on Comparative Anatomy, and particularly on that branch connected with the osteology of the head; and in 1811 I delivered my settled theory on its complete state in my Lectures. An abridged summary of it was given by me in a note on the osseous pieces of which the head of vertebrated animals consisted. (Annales du Museum, vol. XIX, p. 123—128).

I described in great detail the bones of the face of fishes in my Memoir on the Structure of the Upper Maxillary Bone. This was read at the Institute in March, 1814, and was published in vol. I. of the Memoirs of the Museum. In the same volume, pl. 16, I supplied some examples of the varieties of the configuration of these bones, which were taken from the *coryphæna*, *labrus julis*, and the razor-fish. Lastly, in 1817, I published, in my "Regne Animal," three plates of the head of the cod, in which the whole of the bones have their names respectively.

In 1817 M. Blainville published, in the Philomathic Bulletin, a Memoir on the Operculum of Fishes, in which he asserted that the preoperculum was the jugal bone, and that the three other pieces were representatives of those which were found extra in the lower jaw of the reptiles and birds, as compared with that of the fishes. The author affirms that he communicated these ideas long before, and he gives them the date of 1812. But they were instantly refuted by M. Geoffroy, to whom I showed, amongst my preparations, the jaws of a lepisosteus, quite as complicated as that of any reptile, yet this fish actually had opercula as perfect as those of any fish.

In 1818 M. Geoffroy, in his Philosophie Anatomique, announced this fact, and at the same time suggested the notion that the bones of the operculum corresponded with the four little bones of the ear, that is to say, the operculum with the *stapes*, the sub-operculum with the *incus*, the interoperculum with the *malleus*, and a fourth, which is often merely a vestige, to the lenticular (in this country, the orbicular) bones, whilst the preoperculum would be the frame of the tympanum.

The latter system, as in the birds and the greater part of the reptiles, forms a layer, more or less vertical, articulated by its

In the mean time, some important labours had been carried on in Germany upon the subject to which our attention had been directed, but little notice was taken of them by the Parisian anatomists, from a custom which is certainly now decaying. In 1800 M. Autenrieth published, in the Zootomical Archives of Wiedemann, a Memoir on the Anatomy of the Pleuronectes, in which he stated many remarkable points connected with the head of fishes; he considered the branchiostegal rays to be the cartilages of the ribs, and that the bony branches which they bore as composed of the os hyoides and some portions of the sternum, &c., an opinion which was entertained by M. Geoffroy in 1807, and which was the origin of the whole of his theory of the branchial apparatus, as developed by him in his *Philosophie Anatomique*. The operculum, according to M. Autenrieth, is the result of a division of the thyroid cartilage, &c.; but this learned physician devoted little attention in his memoir to the analogy of the bones, with the exception of the apparatus of the tympanum, which he still refers to the condyloid apophysis of the lower jaw, as Hérissant did in the case of the square bones of birds.

In 1811 a memoir by M. Rosenthal appeared in the Archives of Physiology of Reil, on the Skeleton of Fishes; in this the author described all the bones of the head with a fidelity and clearness which were quite remarkable, but in which he has been far less successful as to his investigation of their analogy. According to him, the bone which is my ethmoid, and my two anterior frontals with my vomer, form the upper jaw; my mastoid bones are detached pieces of the parietal bones, my posterior frontal represents the scaly part of the temporal, and my great ala the petrous portion. He gives to the anterior sphenoid and to the orbital wings the names of the body of the sphenoid and its wings. The sphenoid, properly so called, is designated by him the bone of the base of the cranium. His conclusions and mine on the other bones of the cranium completely agree.

With respect to the face, M. Rosenthal has come to no decided inferences. My intermaxillaries and my maxillaries, according to him, are only divisions of a single intermaxillary; he calls a square bone that which I have named the temporal, and gives to the other bones of the palatine and pterygoid apparatus, only vague names which do not indicate their analogy.

M. Oken, in a programme of 1807, had considered that the cranium was composed of three vertebræ, and he calls it the head of the head; the nose was his thorax of the head, and the jaws he thought represented the arms and the thighs. These comparisons made very different impressions on men's minds, and applications of them were made to fishes.

In 1815 M. Spix, in his work called *Cephalogenesis*, saw also in the cranium of the vertebrated animals three vertebræ, but the bones which surround the nose appeared to him analogous to the hyoid apparatus, and those of the jaws the representatives of the anterior and posterior extremities. He there gives figures of the heads of the pike, of the cod, trout, eel, silurus, and the carp, but he has published no acanthopterygian. In his system, my ethmoid is the nasal, my anterior frontal the lachrymal, my anterior sphenoid the ethmoid, my mastoidean the scaly temporal, my posterior frontal a portion of the jugal, my petrous bone a part of the lateral and occipital. As to the rest of the bones of the cranium, he concludes as I do. In the face, he refers the suborbitals to the jugal. My transverse bone and my palatine form together, according to him, the pterygoid bone, and what I call pterygoid he designates the true palatine. The other bones of the pterygo-tympanic apparatus answer in their combination, he says, to the annular portion of the tympanum, but he recognised, as I do, the intermaxillaries and the maxillaries in the bones commonly called the jaws.

It is M. Spix, if I am not mistaken, that first saw the little bones of the ear in the opercula, but he arranges them differently from M. Geoffroy. According to him, the prooperculum is the malleus, the operculum is the incus, and the suboperculum the stapes.

M. Oken, in the *Isis*, No II, of 1818, has translated my various notes on this

postero-superior angle to the side of the cranium, behind the orbit, and by its anterior one to the anterior part of the cranium on the side

portion, and has copied the figures which I had inserted both in the *Annales du Museum* and in my *Regne Animal*.

In No. III. of the same Journal is an arrangement of the bones of the head of fishes by M. Bojanus, an academician of Petersburg, accompanied by figures made on the bream and the pike.

The author differs with me respecting the cranium only by giving a partial assent to the notion of M. Oken, and makes my anterior frontal the cribriform lamina of the ethmoid, and of the posterior or scaly temporal bone. He applies inversely, as I do, the names of the petrous bone and the mastoidean. With respect to the external occipital, he makes an interparietal bone of it, never remembering that it is always outside the parietals. My suborbitals form his jugal, and he calls my jugal the internal pterygoid, my temporal is his chase, my chase is his external pterygoid apophysis; he regards the transverse and pterygoid bones as dismemberments of the palatine. In fine he attempts still to discover the opercula in the pretended pieces wanting in the lower jaw, an idea which M. Oken admires, and which is nevertheless merely that of M. Blainville published five or six years before, and already refuted two years ago by M. Geoffroy.

M. Carus, the same year (1818), in his *Zootomy*, considers also that the cranium is a union of three vertebræ, but he sees in the occipital vertebræ only four pieces, forgetting the superior and external occipitals; in the sphenoidal only five, never thinking of the petrous bone; my mastoideans appear to him to be temporals, my anterior frontal the cribriform lamina of the ethmoid, my first suborbital the lachrymal, the others the representatives of the jugal. He admits two or three palatines, and calls my jugal *os discoïdien*, and vaguely compares those which are above the square bone, or the ascending branch of the inferior jaw; in short, the opercula appeared to him to have motion on the branchial apparatus, very nearly resembling the scapula on the thorax, but he rejects the opinion which makes, of the hyoid bone and the branchiostigal rays, a combination of the hyoid with parts of the sternum, and with the sternal coats.

In 1822 M. Bakker, in *Osteographia Piscium*, has described the bones of the head of the eaglefin and the lamprey. My posterior frontal appears to him to be the petrous bone, as it receives no parts of the ear; my mastoïdaen is his temporal; he takes my petrous bone for the great wing; he calls my suborbitals the jugal bone and the zygomatic bone. With respect to the bones which replace the square bone, he confines himself to designate them by the names of *symplecticum primum*, *secundum*, &c.

M. Van der Hoeven, who has written in 1822, on the skeleton of the fishes, has not ventured on determining the bones of the head.

M. Meckel, in the second part of the second volume of his "*Comparative Anatomy*," printed in 1824, has given page 2, 3, 4, and following a general description of the bones of the head, with observations on their variations in some fishes. As far as I can understand his text without the figures, and in which he does not put everywhere the synonymes of other authors, his distribution only differs from mine in his considering my great wing as the petrous bone, the orbital wing as the great one, and the anterior sphenoid as the orbital wing; inasmuch, that he makes of my anterior frontal an appendage to the ethmoid, and refers the posterior to the temporal, and the preoperculum and jugal to the square bone, or to the articular portion of the temporal, in fine: inasmuch as it is my suborbitals which appear to him to replace the jugal, besides, he very well marks at what point it is necessary that the number of pieces should be constant either in the cranium or the lateral apparatus. He does not speak of the movable pieces of the operculum.

In fine, M. Geoffroy, in 1824 and 1825, made an arrangement of the bones of the head of fishes, different from those of the opercula, with which he was much earlier occupied, and in respect of which he maintains his opinion, that they are the bones of the ear, he distributes the pieces of the head not into three, or four vertebræ like his predecessors, but he sees in and also admits in every other head

of the vomer: this anterior extremity partly supports the maxillary bone; on the postero-inferior angle is the surface for the articulation of the lower jaw.

seven other vertebræ, having each a body, a superior annular part composed of four pieces, and an inferior annular part, also composed of four pieces, nine for each vertebræ, and sixty three in all. Since that time he has considered each body as formed itself of four pieces, which makes, in all, eighty four. The following digest is dated the 12th of December, 1825, to which are added such reflections as suggested themselves me.

Every head, according to M. Geoffroy, is a combination of seven vertebræ, each composed of a superior ring of two pairs of bones, of one body without a fellow, and an inferior ring of two other pairs of bones, as follows:—	And these pieces, according to the same author, are represented in the fishes by the bones to which I give the following names:	Whereou I make the following remarks.	
		On the bones in particular.	On the whole of each vertebræ.
FIRST VERTEBRÆ. <i>Superior Ring.</i> The two ethmophysals, or superior horns of the nose. The two rhinophysals, or inferior horns of the nose. <i>Body.</i> The protosphepal, or cartilage of the nose. The two adnasals, or intermaxillaries.	The proper bones of the nose. The oscending apophyses of the intermaxillary. A cartilage placed between the pedicels of the intermaxillaries and vomer. The intermaxillaries.	These bones always external in the fishes, and placed above the nostrils, cannot be their horns. It is very rare that these apophyses are separated by a suture, and this suture proves nothing except that the bones is not constant. The bones would be much multiplied if all the inter articular cartilages are to be called bones.	This combination of bones wants the essential character assigned by the author to every vertebræ; it has no receptacle for the nervous or sanguineous system.
<i>Inferior Ring.</i> The two addental, or dentary portions of the maxillaries.	The maxillaries		
SECOND VERTEBRÆ. <i>Superior Ring.</i> The two nasal, or proper bones of the nose. The two lachrymals, or os unguis.	The ethmoid.	The bone which I call ethmoid is always simple, and it cannot be made to represent two bones, or two nasals, because it is between the nostrils and not above.	This latter vertebræ has no superior ring, or, rather, it would be double, for the ethmoid would divide it into two; further, the bones which alone can be supposed to form the

The face in fishes is furnished besides with two apparatuses, which are altogether unknown in the preceding classes of animals; for no one, at least, has affected to find them, except through the medium of analogies, which are exceedingly debateable: the apparatus of

		Remarks.
The two lachrymals or os unguis.	The anterior frontals.	These bones exist in the crocodiles, in the tortoises, &c. on the side of the two lachrymals characterized for such, and cannot be substituted for them.
<i>Body.</i> The rhinosphal, or ethmoidal lamina.	The vomer.	
<i>Inferior Ring.</i> The two palatine portions of the maxillaries.	The transverse	
The two vomerals or the vomer.	Parts supposed to be soldered to the vomer.	
THIRD VERTEBRÆ.		
<i>Superior Ring.</i> The two frontals.	The principal frontals.	How can the tarsal cartilages, which are entirely detached, contribute to the superior ring which is closed independently of them?
The two palpebral, or cartilaginous tarsi.		
<i>Body.</i> The Ethmophenal, or body of the ethmoid; the two adorbital, or obitrary portions of the maxillaries.	A cartilage placed behind the ethmoid.	Here, again, is an interarticular cartilage elevated into a bone.
<i>Inferior Ring.</i> The two adorbital or obitrary portions of the Maxillaries.	The first sub-orbitors.	
The two palatals or palatines.	The palatines.	
FOURTH VERTEBRÆ.		
<i>Superior Ring.</i> The two ptéral or great wings of the sphenoid.	The greatwings	This vertebræ is the most disjointed of all for its inferior ring; for neither the posterior suborbitors nor the ptérygoidean have any connexion with the three bones, they are quite wide apart.
The two ingrassian or obitrary wings of the sphenoid.	The obitrary wings.	
<i>Body.</i> The entosphenal or anterior body of the sphenoid.	The anterior sphenoid.	

suborbital bones forming a chain which extends from the anterior frontal to the posterior one, and completing the frame of the orbit which has been abandoned as it were by both the maxillary and jugal bones, and assuming the appearance of the jugal, or representing (if the expression be better liked) the portion of this bone, and that of the maxillary, which, in the mammalia, were beneath the orbit; and the

		Remarks.	
The two jugals or bone of the pommette. <i>Inferior Ring.</i> The two internal ptérygoid apophyses.	The posterior suborbitars. The ptérygoideans.	Here the author abandons his doctrine of the identity of the number of pieces in which one bone must be represented but by one bone. The posterior suborbitars are sometimes very numerous.	
FIFTH VERTEBRÆ. <i>Superior Ring.</i> The two parietals. The two temporals. <i>Body.</i> The hyposphenal or posterior body of the sphenoid. <i>Inferior Ring.</i> The two great tuberosities of the circle of the tympanum.	The parietals. The posterior frontals. The posterior sphenoid. The temporals	In his first essays, M. Geoffroy spoke of a symplectic which he called uro-serrial, in other words, the inferior, thin portion of the frame of the tympanum.	Here the two rings are also disjointed, the one from the other; the posterior sphenoid has no connexion either with the parietals and the posterior frontals, or with the temporals, the chest, and the jugal.
The two Cotyleaux.	The tympanal and jugal, called by M. Geoffroy, epicotyleal and hypocotyleal.	Here, again, the author abandons his identity of the number in the representatives of the bones, because, for the two bones he has made only one. I ought to observe, also, that the cotyleal, or, in other words, the case never, as it appears to me, can be considered as a different bone from the tympanum, of which it is only the continuation.	

apparatus of opercular pieces, which adheres to the posterior border of the palatine and ptérygoido-tympanal system, protects the branchiæ,

SIXTH VERTEBRÆ.			Remarks.
<i>Superior Ring.</i>			
The two interparietals.	The interparietal.	I have never seen the interparietal double in the fishes.	The superior ring is also disjointed for the interparietal and the mastoideans are not in contact.
The two rocks or petrous portions.	The mastoideans.		
<i>Body.</i>			
The otosphenal or anterior portion of the basilar.		I have never been able to detect a transverse division of the basilar.	
<i>Inferior Ring.</i>			
The inferior parts of the circle of the tympanum.	The preopercula		
The two mallei.	The interopercula.	The interopercula are attached to the lower jaw, and take a part in sustaining the os hyoides; they have no muscle proper to themselves. Now, how is it possible to reconcile this with the characters of the malleus?	
SEVENTH VERTEBRÆ			
<i>Superior Ring.</i>			
The two supra-occipitals.	The external occipitals.		All the world knows
The two ex-occipitals.	The lateral occipitals.		that the basilar, the two lateral occipitals,
The basiphenal or posterior portion of the basilar.	The basilar.		and the superior occipital, represent, between them, a sort of
<i>Body.</i>			vertebræ, and this analogy dwelt upon by M.
The two stapes.	The opercula.	I think I have amply refuted the supposition that the opercular pieces are bones of the ear, for I have pursued my enquiry into the gradually reduced and simple state of the apparatus constituted by these bones from man to the salamander amongst the reptiles. (See my Researches (b) on Fossil bones.	Dumeril is perhaps all tyah is true in the manifold superstructures which various authors have built upon it.
<i>Inferior Ring.</i>			
The two incudes. (a)	The sub-opercula.		

(a) This is the plural of *incus*, the anvil of the ear.—*Eng. Ed.*

(b) We are happy to be able to inform the reader, that we shall speedily give him the opportunity of making this reference to a translation now about to be published by the proprietor of the present work.—*Eng. Ed.*

and opens or shuts according as the motion of the water for respiration may require.

Of the Cranium.

It is between these four apparatuses, the maxillary, suborbital, pterygo-tympanic and opercular, that we find the cranium or cerebral box, which, as usual, contains the nose and eye in the external fossæ, the of the ear in the internal lateral cavity, and in its general cavity, the labyrinth brain; this cranium, as in other vertebrated animals, is a sort of a cage or envelope, composed of pieces which are united, so as to be immovable, by sutures.

The cranium in the Acanthopterygians may be regarded as the most correct type, in other words, it is that cranium in which the bony constituents are most approximated to their complete state, and the most advanced in their development respectively: they undergo a variety of modifications in the other orders, but in such a way as that when once the student establishes in his mind a complete idea of this primary form, he can always, with the greatest facility, determine the rest by induction. Between the skulls of the reptiles and the birds, a striking analogy is observed* in both, for it is by no means difficult to find the whole of the parts, and this will be manifest to those who will take the trouble of examining with us now one of the crania; that of the common perch for example. In the other acanthopterygians we have the same bones, with the difference only of proportions between these individual bones and the aggregate which they compose. This is likewise the reason why we cannot limit ourselves to a mere generic description of them according to their number, connexions; and functions, without at all entering into the details of their figures, which would be only convenient in this single instance, and, perhaps, would only perplex the other part of the explanation †, pl. I. A. the superior face fig. 1. the principal frontal, forming the arch fig. 1, of the orbit and the anterior portion of that of the cranium. Both before and behind it there are bones which form the anterior and posterior pillars of the orbit, and which correspond to the anterior and posterior frontals of the reptiles.

* It is recommended to the reader to peruse the portion of the chapters in my work, on the Fossil Bones, where I have described the cranium of the reptiles.

† In order to facilitate the study of the osteology of fishes, that of the perch is given in all its particulars in plates I, II, III. Plate I, presents the entire skeleton; it gives a lateral view of the entire head, and also the apparatus of the face in their natural situation. Figures I, II, III, IV, of plates II, give the cranium and the pieces composing it, as seen in fig. I. in a lateral aspect, fig. II. the upper part, fig. III. the upper part, fig. IV. the hind part. Fig. V. is the cranium seen from below with one side of the face; the gills are removed. Fig. VI. presents, on the contrary, the cranium from which the apparatus of face have been taken away to show the attachment of the gills and the shoulder. Fig. VII. is a vertical and longitudinal section of the cranium, the left half being removed to show the inside part of the right. Fig. VIII. is a vertical and transverse section, showing its anterior side from within. Fig IX. is the part opposite the same section, and shows within the posterior side of the cranium. Lastly, the Fig. X. is a horizontal section, which shows the root of the skull. In all these figures the same bone has the same number.

The anterior frontals, fig. 2, form the pillar of the forepart, allowing the olfactory nerves to pass between them, as in all the animals in which these bones exist. The ethmoid, however, fig. 3, forming at this point a vertical partition between which and the anterior frontal, the nerve on either side passes by a slight fissure in the latter, but very often through a hole in the anterior frontal, and not by a fissure; still, this bone is not the less capable of being recognised for what it really is. In the conger and common eel it remains in a permanent state of cartilage; if the skeletons be too long macerated, the bone will disappear. The anterior frontal has an articulating surface on its inferior edge for the palatine, fig. 22, and frequently, on the outside of the latter, another for the first suborbital fig. 19*.

The posterior frontal, f. 4, forms the posterior pillar of the orbit, and co-operates in supplying an articulation to a bone to which I give the name of temporal, f. 23†.

The axis of the inferior surface is occupied as usual by the basilar, f. 5, and the sphenoid, f. 6. The latter bone is continued forward, as in the birds, into a long apophysis which is the base of the interorbital partition, this partition remaining in the greatest number of fishes, membranous ‡.

Taking these elementary indications for our guide, we come to conclusions which can be demonstrated very easily in other bones; but we also become acquainted with the fact that, as in the birds and reptiles, their number is not the same as it is in the human foetus, and what is more, we shall see that it is not constant either in the various fishes.

The two parietal bones may be easily distinguished behind the

* M. Spix, in conformity with his general system, takes the anterior frontal of the fishes for a lachrymal, and M. Oken for an os planum. We have to apply to these theories the very same objections as we have given in our osteology of the crocodile in our work on Fossil Bones. In these animals this bone is situated beside a cartilaginous ethmoid, which it envelopes, as the anterior part of the frontal covers the ethmoid in the Ruminantia. M. Bojanus, no doubt taking into consideration the aperture which he finds in several fishes for the olfactory nerve, makes of it a sieve-like lamina from the ethmoid; but this opinion, which has not the same ground for support in the whole of the species, is overturned besides by the other relations which this bone bears to the adjacent ones. Now, with respect to M. Rosenthal, who arranges it as a portion of the upper jaw, the only way in which I can explain his notion, is to suppose that he did not study the reptiles in which the anterior frontal is actually detached wholly from the jaw by a lachrymal. M. Geoffroy and M. Carus, call this bone a lachrymal, as does M. Spix. M. Bakker adopts my nomenclature, but he denominates the frontal bone the osbital.

† Authors differ much on this posterior frontal. According to M. Bosenthal and M. Bojanus, it is the scaly portion of the temporal; to M. Spix it is a part of the jugal; to Bakker it is the pethous bone. M. Geoffroy takes up the notion of the first two, and calls this bone the temporal.

‡ Every body seems to be agreed respecting the posterior sphenoid, with the exception of M. Geoffroy, who makes out in the first a transverse division which I am utterly unable to detect. He calls the posterior and segment basisphenal, the anterior ostosphenal; and the sphenoid hyposphenal. M. Rosenthal gives to the sphenoid the vain title of bone of the base of the cranium, (in the German *grund-bein*). M. Meckel understands the reunion of the basilar, the sphenoid, and the lateral bones which are attached to it.

frontal ones, but they touch one another only very rarely;* almost always they are separated by means of an azygos bone from which the occipital spine proceeds vertically, it being very large in a great number of fishes, and is frequently prolonged anteriorly into a true sagittal crest. In such a case we are naturally tempted to give to this azygos bone, the name of interparietal;† but sometimes, as in the carp for example, the parietals touch one another for a considerable portion of their length, and then the bone just mentioned, is behind the parietals, and thus must be considered as a superior occipital: its function would therefore resemble very much that which belongs to it in the tortoise. In some fishes, but especially in the family of the silures, the parietals are wholly absent, and are replaced by this azygos bone in a very large state of development.

On the sides of the latter, as in the tortoise, there are two pairs of bones which form the lateral portions of the occiput, these correspond exactly to those, which I have designated in the tortoise, as the external occipital (No. 9,) and lateral occipital (No. 10.)

It would perhaps be better to call the single bone of which I have spoken, the *interparietal*, in which case, the two external occipitals might be regarded, as a superior occipital divided into two;‡ they both form the summit of the first lateral ridge of the cranium, that which I call *intermediate*, to which one of the apophyses of the supra scapular is attached. On the inside of the cranium, the lateral occipital (No. 10,) often furnishes a lamina, which unites with its fellow, to form a roof for the sacs in which the stones of the ear are enclosed. It sometimes presents a singular conformation, in the carp, being pierced with a large hole.

The basilar or inferior occipital (No. 5) occupies its usual place, and the articular facet forming a hollow cone, by which the head is attached to the body of the first vertebra, entirely belongs to it; but the other two small facets, which, in a great number of species converge to the articulation of the head with the articular facets of this vertebra, belong to the lateral occipitals (No. 10.)

Before the lateral and inferior occipital, from each side of the noid arises the *great or temporal wing*, which always unites by suture to the posterior frontal (No. 4)† and furnishes conjointly with it, an articular facet to the temporal bone. The two last branches of the fifth pair pass through a hole or fissure of this piece. In the inside of the cranium, this great wing often gives anteriorly a roof to the pituitary gland in the same manner as the lateral occipitals cover the stones of the ear.

* It would appear now that at last all the world, with even M. Geoffroy at the fag-end, is agreed respecting the parietals.

† M. Geoffroy has decided by giving also to this the name of *interparietal*, and I am not aware of any person who does not coincide in its propriety.

‡ M. Geoffroy has also adopted this determination, he calls these two pair of bones, the *superoccipital*, and *exoccipital*. M. Bojanus calls the external occipital, *interparietal*.

‡ M. Geoffroy who has at length adopted the same determination, calls it *ptereal*. All naturalists are now agreed respecting this bone, with the exception of M. Rosenthal and M. Meckel, who look upon it as the petrous bone.

To complete the posterior and superior lateral angle of the cranium, one, and sometimes, two bones are always found, on each side, between the posterior frontal, the frontal, the parietal, the internal occipital, the lateral occipital and the great wing; the first, (No. 12), is manifestly the same as that which I have called *mastoidean* in the crocodile and tortoise.† It contributes with the posterior frontal, and sometimes with the great wing to form the articular surface of the first bone of the palatine, and tympanic apparatus, that bone which I have called the temporal. This *mastoidean* bone, in fishes, is prolonged into an apophysis more or less prominent, forming the summit of what I call the external ridge of the cranium, and gives attachment to one of the apophyses of the superior bone of the shoulder or suprascapular.

When there are only two of these to complete the angle of the cranium, a disposition which obtain almost always in the Acanthopterygians, the only name I can find for the second, (No. 13) is that of the petrous bone. It is in general small, and placed between the *mastoidean*, the lateral occipital and the great wing; sometimes it is very large, and descends as low as the inferior occipital and the sphenoid‡ as in the cod; it is also often entirely wanting, as in the pike, carp, and eel.

In front of the great wing, but somewhat higher, a piece (No. 14) which may be called the orbitary wing is dove-tailed with the great wing, and with the posterior frontal, and frontal§. Between this and its fellow, the olfactory nerves pass above, and the optic nerves below; they both unite, sometimes as in the carp, thus forming a roof over the optic nerves.

Below, and in front of the orbitary wings, a single bone is found, (No. 15), it is most commonly implanted by a solitary lamina on the sphenoid, it bifurcates above to join, sometimes the two orbitary wings, sometimes the two great wings, it also sometimes remains suspended in the interorbitary membrane, which unites all these parts! This is an *anterior sphenoid*, very analagous, as in the pike, to what obtains in the lizards;|| but sometimes as in the cyprins, and the silures, this bone is large, and is united not only to the sphenoid and orbitary wing, but to the frontal, and anterior frontal; in this case, it

† M. Geoffroy at present calls my *mastoidean*, the *prerupeal*, and my petrous bone, the *postupeal*, and considers both as parts of it. M. Spix regards it as the scaly temporal, and a part of the lateral occipital. M. Bojanus gives them names, the inverse of mine. M. Bakker thinks my *mastoidean* is the temporal. M. Meckel alone agrees with me, in regarding it as a substitute for the mastoid apophyses.

‡ It is the petrous bone of the *eglefin* which M. Bakker has taken for the great wing of the sphenoid, of which it has in reality the appearance in the cod species. M. Meckel points out this bone, but does not determine it.

§ M. Geoffroy who has adopted my determination, call this piece *ingrassial*. M. Rosenthal calls it simply the wing of the sphenoid. M. Meckel looks upon it as the great wing.

|| According to M. Rosenthal, it is this bone that forms the *body* of the *sphenoid*; according to M. Spix, it is the *ethmoid*. M. Meckel makes of it the *orbitary wing*. M. Geoffroy adopts my determination, and calls it the *entosphenal bone*.

replaces entirely the interorbital membrane by a continuation of the cavity of the cranium, which extends as far as between the anterior frontals. In others, the sciæna for instance, the interorbital membrane is more or less ossified by productions of the sphenoid, or of the anterior frontals, or even of the ethmoid, which extends into the membrane. In some fishes, in fine, the anterior sphenoid is entirely wanting, all this part being membranous.

This point settled, it only remains to determine the two bones that form the anterior end of the cranium, one above, the other below. The under one, No. (16), is continuous with the sphenoid; the upper one with the frontals and anterior frontals; moreover, they are joined to each other vertically, and the cavities of the nostrils are situated at their sides, so that they form together the partition. The under one is often furnished with teeth on its inferior surface. I do not hesitate to regard this as the *vomer*, and the other the *ethmoid*, that is to say, what is called the vertical lamina of this bone in the mammalia. All their connexions confirm this determination.†

It sometimes happens, as in the conger, and the common eel, that the ethmoid and vomer form but one bone.

Thus the cranium of fishes, when its pieces are complete is composed of twenty-six bones, vid. six azygos, the *basilary* (No. 5), the *principal sphenoid* (No. 6), the *anterior sphenoid* (No. 15), the *vomer* (No. 16), the *ethmoid* (No. 3), and the *interparietal* or *superior occipital* (No. 8); and 20 pairs: the *principal frontal* (No. 1), the *anterior frontals* (No. 2), the *posterior frontals* (No. 4), the *parietals* (No. 7), the *mastoideans* (No. 12), the *external occipitals* (No. 9), the *lateral occipitals* (No. 10), the *petrous bones* (No. 13), the *great wings* (No. 11), and the *orbital wings* (No. 14).

To finish the description of the exterior of the cranium, it should be observed, that it generally presents, behind the occiput, five prominent points, which are often prolonged anteriorly or posteriorly into ridges; the middle one of these corresponds to the spine of the occiput; it belongs to the interparietal, and often extends forwards over the suture of the frontals, and backwards on that of the lateral occipitals: the spinous processes of the dorsal vertebræ follow in its suite, and are attached to it by a ligament analogous to the cervical ligament of quadrupeds. The second which I call *intermediate*, there being one on either side, each runs on the external occipital, and is prolonged forward on the parietal, and sometimes on the frontal of each side. It is to its prominent extremity that the superior branch of the superior bone of the shoulder which I call *superscapular*, is attached. Lastly, the third ridge, which I call *external*, belongs to the mastoidean bone, and is prolonged forward on the posterior frontal, and on the side of the principal frontal, and backwards on the petrous bone, and lateral occipital; to its posterior extremity which

2d. † With my ethmoid, two anterior frontals and vomer, M. Rosenthal forms what he calls, the *upper jaw*. M. Spix regards my ethmoid as the *nasal*. M. Geoffroy adopts my determination respecting it, and call it the *ethmosphenal*; but he considers my vomer as the vertical lamina of the ethmoid, and calls it *rhinosphenal*. M. Bakker and M. Meckel agree with me as to both these bones.

belongs to the mastiodean is attached the second, and sometimes the only branch of the super-scapular bone, whose third branch, when it exists, is attached more deeply. Under this third ridge, in a fossa scooped under the mastoidean and anterior frontal, the palatine and temporal apparatus are articulated posteriorly, by means of the bone which I call the *temporal*; it is also from this ridge, that the ridge which goes to form the post-orbital apophysis of the posterior frontal, is commonly detached.

The existence, or absence of these prolongations, and their greater or less extent have considerable influence over the particular form of each cranium, and even on that of the whole body of the fish; thus fishes whose bodies are compressed, and whose backs are raised much above the head, present the middle ridge much elevated also, and the laterals in proportion; on the other hand, in fishes whose heads are depressed, and bodies round, these ridges are effaced, or are reduced to spinous elevations which are found only at the occiput and from before backwards. When the cranium is both large and flat, the external ridges usually form its lateral edges. The arches more or less large, more or less concave, which are sometimes found on the sides of the cranium, as in the cyprius and certain silures, may be classed amongst the most remarkable conformations; yet their formation depends simply on the greater degree of prominence of some of the parts we have enumerated, or on their union with each other by one or two more sutures, as we shall have occasion to observe in the sequel. It may be therefore affirmed in general, that in bony fishes, whatever be the variations in the general form of their cranium, its composition is nevertheless almost constant, and that the exceptions to this rule, although pretty certain, are by no means numerous.

Fossæ of the Cranium.

The superior arch of the great cerebral cavity is formed by the posterior part of the frontals, the parietals, the interparietal, and the external occipital. The posterior frontals and the mastoidean form part of its lateral walls. The orbitary wings are at each side of its anterior wall. The floor is formed by the superior branches of the anterior sphenoid, and by the great wing; lastly, this cavity terminates posteriorly in a canal, which is entirely surrounded by the lateral occipital. This canal, strictly speaking, forms the *posterior fossa*. The *anterior fossa* is most commonly altogether membranous; its place in the skeleton is marked by a large hole, limited laterally by the orbitary wings, above by the frontals, and below by the bifurcation of the anterior sphenoid. There are however some kinds, such as the cyprins and silures, in which, as has been already said, the orbitary wings, and a very large anterior sphenoid unite to furnish, in all its parts, the anterior fossa with bony walls, excepting the orifices necessary for the transmission of vessels and nerves.

The *middle fossa* is limited in front by a transverse crest of the orbitary wing, and behind by another, which exists on the internal surface of the great wing, and of the posterior frontal. These two crests are joined behind. At the bottom of this fossa, behind the bifurcated part of the anterior sphenoid, and sometimes, as in the

carp, behind the union of the orbitary wings, there is a hole leading into a large canal, which is situated behind under the middle posterior fossa, surrounded superiorly and laterally by lamina of the great wing, inferiorly by the sphenoid, and terminating in a funnel in the basilar. In front it lodges the pituitary gland, and gives passage into the cranium to the vertebral arteries. The existence of this cavity is not constant; for instance, it is wanting in the cod, whose pituitary gland is but slightly encased.

The *cavities of the ear* lie between the middle and posterior fossa. In the quadrupeds, these cavities are enveloped in the petrous bone, and form a prominence in the interior; in birds and reptiles, they occupy several of the neighbouring bones; and in bony fishes they communicate openly with the cranium. These cavities consist, 1st. of two great fossa scooped out beneath the cavity in which the brain is lodged, and are prolonged to the sides of the posterior fossa: they are surrounded by the great wing, the lateral occipital and the basilar, and serve to lodge the sacs containing the large stones of the ear. 2d. of different depressions which occupy the lateral posterior angle of the cranium, extending into the external occipital, the mastoidean, the lateral occipital, and even a little into the parietal, the posterior frontal, and the great wing, and serve for the lodgement of the semi-circular canals.

Foramina of the Cranium.

According as the closure of the cranium in front is more or less complete, there are varieties, not precisely in the holes which pierce this cavity, but in the mode in which they are surrounded by the bones. Thus in most of the acanthopterygians, and in the perch, which we take as a type, the olfactory and optic nerves, and those of the third and fourth pairs merely pass through the membrane which closes the large opening situated in front, between the frontals, the orbitary wings, and the anterior sphenoid. The same obtains in the cod, in which, moreover, the fifth pair passes through a fissure only, of the anterior edge of its great wing; whilst in the perch, not only is there in the middle of this great wing holes for the branches of the fifth pair, but one near its edge for the sixth. The eighth pair passes out by two holes through the side of the lateral occipital; and the tenth by one in its superior surface, not far from the occipital hole.

In the bony skulls, we may also observe certain solutions of continuity, which in the fresh state, are only closed by membranes or cartilages; thus the perch and several other acanthopterygians have a remarkable one on each side, between the parietal, the mastoidean, and the external occipital; it is likewise seen in the pike, which also possesses another between the posterior frontal, the great wing, and the mastoidean; it is even in the middle of this cartilage in the pike, that we find suspended a very small vestige of the petrous bone.

We have already spoken of the very large hole in each lateral occipital of the cyprins. These fishes have a small azygos bone, between the parietals and the interparietal; some of the silures present

a slit in this situation, and another more in front between the two frontals, &c.

Upper Jaw.

To recognize easily the *intermaxillaries* and the *maxillaries*, they should be seen in the salmon, or in trouts properly so called.* In such fishes, these bones are situated in the same manner as in all the mammalia and reptiles; the intermaxillaries (No. 17) on the front of the jaw, having little mobility; the maxillaries (No. 18) at the sides as far as the commissure, armed with teeth, which continue the series of those of the intermaxillaries. On each side, within the maxillary teeth, there is another series of teeth belonging to the palate, as in serpents, and in the middle there is a band of them, adhering to the longitudinal bone, which is, as we have remarked, analogous to the vomer. This structure obtains in the smelts, the graylings or coregoni, and throughout the entire family of the herrings. In the polypterus, the resemblance to the mammalia and reptiles goes still farther; its maxillaries and intermaxillaries are immoveably attached to the rest of the head.

There are structures more or less analogous in other different kinds, but in the greater number of fishes, as in the cyprins, and almost all the acanthopterygians, the intermaxillary (No. 17) forms almost the whole of the edge of the superior jaw, and is moved by causing one ascending apophysis to glide before the anterior extremity of the cranium, which extremity is formed, as we have said, by two bones analogous to the ethmoid (No. 3,) and vomer (No. 16). The *maxillary* (No. 18) is placed parallel to the intermaxillary, and forms what is commonly called the *labial* bone, on account of its being sometimes covered with a fold of skin representing a lip, or the *mystachial* bone, from its representing a sort of moustache, and from this bone being sometimes prolonged into a little fleshy barb or true moustache, as is seen particularly in the silures. This maxillary bone (No. 18) is joined by moveable articulations to the intermaxillary (No. 17), to a prominent facet of the vomer (No. 16,) and to a slightly curved apophysis of the palatine bone (No. 22.) It is thus that the intermaxillary, the maxillary and palatine bones, with the apparatus attached to this last, are moved on each other, and on the cranium. The maxillary (No. 18) is sometimes subdivided into two or three pieces, as in the herrings, or even into a much greater number as in the lepisosteus. The ascending apophysis of the intermaxillary (No. 17) is sometimes distinguished from the rest of its body by a suture:† an

* These parts in the trout are represented pl. iii. fig. v. with the same numbers as in the figures taken from the perch; the entire face of the latter is represented in situation, pl. iii. fig. i. and all the bones detached from each other fig. ii.

† I thought for some time that the labial bone corresponded to the jugal. M. Fischer seems to regard it in the same light in his treatise on the intermaxillary bone, in which he considers the anterior extremity of the cranium as corresponding to the upper jaw. M. Rosenthal adopts the ideas of M. Fischer on this latter point, but thinks that the labial is but a dismemberment of the intermaxillary. In 1811, I recognized the labial for what it really is, by observing it in the trouts, and I find that this opinion has been since adopted by all the osteologists except M. Rosenthal. It is, indeed, evident to any person who commences the study of this bone in the trout, and other species, in which it forms part of the edge of the jaw.

instance of this is seen in the Polyprion.* The cyprins have something more particular in three small bones, placed between those of the jaw and cranium, of which we shall speak in another place.

The form of the snout in fishes depends generally on that of the intermaxillaries, sometimes flat horizontally, or compressed on the sides; sometimes obtuse or rounded; sometimes advanced beyond the mouth, presenting a prominence more or less salient, and sometimes even enormous, as in the xiphias; sometimes prolonged with the lower jaw to a sort of beak, as in the gar fish. It is more particularly on the length of these ascending pedicles, and of the intermaxillaries, that the greater or less protractibility of the mouth depends, that is, of the power which the fish possesses of projecting it suddenly beyond the snout; but all these circumstances, of which we speak, when treating of each kind, have no influence on the composition of these parts.

The Nasal, Suborbital and Supertemporal Bones.

The nasal, suborbital and supertemporal apparatus in fishes varies the most, as to the number of pieces composing it. The first *suborbital* (No. 19,) the boldest in general as to form articulates with a facet of the inferior external apophysis of the anterior frontal; a circumstance which might cause it to be regarded as analogous to the lachrymal.† It forms the external or inferior border of the cavity of the nostril, whilst the internal or superior border is formed by the *nasal* (No. 20,)‡ which articulating above with the frontal (No. 1,) descends along the anterior ridge of the ethmoid (No. 3,) and with its inferior part sometimes covers the junction of the palatine (No. 22) with the maxillary (No. 18), and of the maxillary with the intermaxillary (No. 17.) To this first suborbital (No. 19) is united a chain of bones, varying in size and number (No. 19,)|| which terminates in an attachment to the posterior frontal (No. 4) after surrounding the inferior half of the orbit. At most this chain of small bones might be said to represent that portion of the jugal bone, which occupies the same situation in a great number of animals; it even sometimes happens that a part of these bones gives off a lamina, which passing under the orbit, forms an incomplete roof. These bones constitute a cuirass for the jaw, the crotaphite, and the neighbouring muscles in certain fishes, the gurnards, the scorpens, certain salmons, &c.; other small bones are not unfrequently found in their suite, forming a similar chain behind on each side (No. 21) between the external apophysis and the intermediate apophysis of the cranium, and covering the articulation of the superscapular bone (No. 46),

* It is this apophysis thus separated that Mr. Geoffroy takes for the inferior horn of the nose, and which he calls *rhinosphenal*.

† This is the *adorbital* or orbitary portion of the maxillary of M. Geoffroy, M. M. Spix, Bojanus, Bakker, and Meckel refer it, as well as the succeeding ones, to the *jugal*. M. Carus to the *lachrymal*. I am induced to consider this apparatus as differing from those of other vertebræ, on account of its covering the muscles, instead of giving attachment to them.

‡ This is the *ethmophysal* or superior horn of the nose of M. Geoffroy.

|| These are the *jugals* of M. Geoffroy.

with these two apophysis;* the latter are at all events most certainly peculiar to fishes, nor can we perceive where it would be possible to discover any thing analogous in other classes, we shall call them *supertemporals*.

Palatine Arch, or Palato Pterygoid, and Temporal System†

This system is composed of seven pieces on each side. It comprehends clearly the palatine in front, (No. 22), the *temporal* behind (No. 23), but as to the rest, its composition cannot be well explained, without including in it, the *pterygoidean*, the *transverse* of reptiles, and and the *jugal*; but it is very difficult to apply these names, even supposing that their application can be made with any degree of verisimilitude.

As far as the *palatine* (No. 22) is concerned, these difficulties do not exist, for it is situated as it is in serpents, and is even frequently furnished with teeth.

There are two bones behind the palatine, one of which, (No. 24), narrow and arched, forms the external border; the other large, flat, and thin, forms the middle and internal part of this portion of the apparatus. It is natural to think that these are the analogous bones, the former (No. 24), to that which I have called the *transverse* in those reptiles, and the latter (No. 25), to the internal *pterygoidean*; the situation of the latter, (No. 25), seems to indicate its name; the former, (No. 24), also is situated much in the same manner as the *transverse*; but it is not articulated with the maxillary, this bone being freer in its movements, than that of lizards, and it is attached in a different direction to the *jugal*, (No. 26), because this bone is situated much farther back.‡

For reasons which shall be deduced by and bye, I take for the *jugal* a large and usually triangular bone, (No. 26), situated behind this *transverse*, and furnishing by means of a *gynglimoid* facet of its inferior angle, the articulation to the lower jaw.

* M. Bakker who seems to me to be the only anatomist who has distinguished these small bones, calls them *supertemporals*. We adopt this name.

† In the IX Volume of the Memoirs of the Museum, page 6, M. Geoffroy gives drawings of the palato temporales laminae of the Codfish, and the Merræ, but without explanation. At a later period, in 1824, and 1825) he gave another which is nearly the same as mine, except that he makes of my jugal and tympanal, his hypocotyleal, and epycotyleal; he regards them, therefore, as dismemberments of one bone of the case, which bone he considers to be distinct from the three pieces, which, according to M. Serres, compose the circle of the tympanum; of my temporal and preopercula, he makes his serrial and his tympanal; which means that they represent two parts of the frame of the tympanum; lastly, he calls the seventh bone, the uro-serrial, by which he means to compare it with the slender piece, which according to M. Serres forms a third piece for the circle of the tympanum.

‡ M. M. Bakker and Meckel come to the same conclusion as I do on these bones: M. Geoffroy also agrees with us; M. Bojanus regards them as separated members of the palatine; M. Carus seems to entertain the same idea; M. Spix names my pterygoid the palatine; and he also considers the *transverse* and the *palantine* as forming together the *pterygoidean*.

Above this bone, and behind the pterygoid there is another large and flat bone (No. 27,) and above the latter, a large one (No. 23,) the same which I have already named *temporal*; it is articulated by a gynglimus with the two bones of the cranium, which we have mentioned as corresponding to the posterior frontal (No. 4,) and the mastoidean (No. 12). This temporal furnishes behind an articular tubercle to the principal piece of the opercle (No. 28,) and gives inferiorly an attachment to a bony stile (No. 29,) which supports the branch of the oshyoides, and which represents the styloid bone in the mammalia.

Behind these three pieces, runs lengthwise the bone (No. 30) which serves as a fixed border for the motions of the opercle; I have named it the *preopercule*. But there is still between the flat intermediary bone and the preopercule another long narrow bone (No. 31,) which passes partly behind that to which the mandible is articulated, and which forms an angle with the styloid.

It may be remembered that in birds, the bone which I have called the square bone, and which I consider analogous to the *caisse*, is articulated on one side with the cranium, on the other with the internal pterygoid and the jugal, and gives attachment below to the lower jaw. The functions of that bone are here performed by the four bones just described, not including the preoperculum; but these four bones are not on this account, dismemberments of the *caisse*, on the contrary, three of them join it, to assist in some measure in filling up the large space, which was here necessary between the temple and the lower jaw for lodging the branchial apparatus. I believe that I have been enabled to determine them properly by comparisons with lizards and frogs. In lizards, the iguana for instance, or the monitor, the bone which I have thought proper to regard as analogous to the scaly temporal, is articulated with the posterior frontal, and the mastoidean; and to it, is chiefly suspended, the tympanal or bone of the *caisse*. Let it be supposed that this bone acquired mobility, that it moves on the two bones to which it is immoveably articulated, it will correspond to the upper one of the bones we are now examining (No. 23) that which unites the palatine and pterygoid apparatus to the cranium. This bone, as I have said, would therefore be the *temporal*.* On the other hand, we have seen in frogs† a jugal and a zygomatic evidently recognizable, passing from the maxillary to the lower part of the tympanal, and sharing in the articulation of the lower jaw, in which it somewhat reminds us of what occurs in the kangaroo. Let us suppose it to supersede the tympanal of this articulation, in the same manner as the tympanal supersedes the scaly temporal in the other oviparous animals, that it takes entirely to itself, and on the other hand, that it abandons the superior maxillary, retaining no attachment whatsoever with it, we shall then have our inferior bone of the apparatus in fishes (No. 26), that which presents a facet to the for the articulation of the lower jaw. This bone would then be, as I have

* This is the *serrial* of M. Geoffroy, the *symplecticum primum* of M. Bakker, the *square bone* of M. Rosenthal, the *caisse* of M. Bojanus.

† See my researches on fossil bones.

just stated, the *jugal* which I consider it to be, notwithstanding all the singularity, of its change of place and functions.* The thin flat piece (No. 27) situated between the temporal and jugal, will then no longer represent the body of the tympanal, or *caisse* deprived of its articular facets, because it is no longer required to concur in determined motions which are provided for in its stead, by the two bones which are attached to it above and below; it is also reduced to a flat disk, because it is no longer required to contain either the cavity of the *caisse*, or the small bones of the ear.†

We have remaining the seventh bone (No. 31) that which is partly concealed behind the internal surface of the jugal; I can find nothing analogous to it in reptiles; for I do not consider as such, the bone which forms a slender column in the lizards; this bone, therefore, I shall call the *symplectic*.‡

These seven bones are joined together, and to the preoperculum by synchondrosis, and have little or no motion on each other; but together they form a large lamina, which moves with facility on the two hinges furnished to it by the anterior articulation of the palatine (No. 22,) with the maxillary (No. 18,) with the vomer (No. 3,) and the superior articulation of the temporal (No. 23,) with the posterior frontal (No. 4,) the mastoidean (No. 12,) and with the great wing (No. 11). This movement separates the lower borders of the lamina from each other, and widens the mouth, when the fish takes in the water necessary for its respiration; the contrary movement forces the water out.

Opercular Bones.||

The *preoperculum* (No. 30)§ is a bone commonly of a square form, which surrounds the posterior border, and the angle of the great palato-temporal lamina described above, and belongs to this lamina rather than to the opercular system itself. Its form, and the indentations or spines, with which its border or angle are often armed vary much; and as these variations are visible externally, they have afforded proper characters for the distinction of fishes.

The principle piece of the *operculum*¶ to which I leave this name exclusively (No. 28,) is situated behind the ascending border of this preoperculum, and moves on it as the fold of a door on its hinge; but at its upper anterior angle, the operculum presents a small dimple

* This is the *hypocotyleal* of M. Geoffroy, the *os 'discoideum* of M. Carus, the *internal pterygoid* of M. Bojanus, the *symplecticum quartum* of M. Bakker.

† This is the *epicotyleal* of M. Geoffroy, the *symplecticum tertium* of M. Bakker, the *external pterygoid apophysis* of M. Bojanus

‡ This is the *uro-serial* of M. Geoffroy, the *symplecticum secundum* of M. Bakker, the *styloid* of M. Meckel. The other anatomists seem to have neglected this piece, which is not very apparent.

|| For all that concerns the skeleton of the respiratory apparatus of fishes. M. Geoffroy's, where Anatomical Philosophy may be usefully consulted, in which the parts of this apparatus are described with great care, and represented very faithfully, although the author's theory is, in my opinion, very far from satisfactory.

§ The tympanal of M. Geoffroy, the *malleus* of M. Spix.

¶ The *stapeal* of M. Geoffroy, the *incus* of M. Spix, the *operculum* of all other anatomists.

which articulates, by diarthrosis, with a convex tubercle presented to it by the temporal (No. 23).

Under the posterior and inferior borders of the operculum, there is another osseous piece (No. 32,) which I call the *sub-operculum*,* and in front of it, under the inferior border of the preoperculum, and behind the articulation of the lower jaw, there is a third (No. 33,) which I call the *interoperculum*.† This interoperculum is of particular importance, on account of the attachment it furnishes to the branch of the oshyoides at the place where it is itself attached to the styloid, which suspends it to the temporal, from this it results that the opercular lids can neither open nor close, without the branches of the oshyoids executing a corresponding movement.

Amongst the common bony fishes, this sort of moving lid which opens and closes the *branche*, is almost always composed of the three pieces just described.

We have seen that several ingenious anatomists have imagined them to represent the small bones of the ear in Mammalia; but besides the arguments, which in another work‡ we have deduced from the successive simplification of the apparatus of these small bones, and their final reduction to a single bone in the last of the batrachian reptiles, the more we examined the opercular pieces the more we shall be convinced, that they do not present the slightest relation with these small bones, either in their connexion with each other, in the connexion with other bones, or in the muscles which put them in motion.

The Lower Jaw.

The lower jaw is formed of two branches joined together in front, each articulated behind, by a hollow facet with the pully which terminates the jugal (No. 26) of its side. In the majority of fishes, when they have attained a certain size each of these branches is composed of two principal bones; the *dentary* (No. 34)|| to the superior borders of which the teeth adhere and the *Articular* (No. 35§ to which the facet for articulation belongs. They unite chiefly by a point of the latter, which penetrates into a re-entering angle of the former. A third smaller bone (No. 36) is frequently detached from the posterior angle under the *articular*, and may be called the *angular*¶ and sometimes a fourth is found (No. 37) at the internal surface of the articular; it corresponds to the opercular in reptiles.** It is only in a few fishes, the *lepisosteus* for example that the same bones are clearly found, as in the lower jaw of crocodiles, tortoises, and lizards. The fact, however, will not suffice to sustain M. Blainville's opinion, too readily adopted by M. M. Bojanus and Oken, who supposes,

* The malleal of M. Geoffroy.

† The inceleal of M. Geoffroy, the stapes of M. Spix.

‡ Researches on fossil bones.

|| The subdentale of M. Geoffroy.

§ The submalleal of M. Geoffroy.

¶ The subcotyleal of M. Geoffroy.

** The submoveral of M. Geoffroy.

that, when these bones are wanting they are transformed into opercular pieces.

The under jaws of fishes do not vary less in their forms, and are no less constant in their composition than the crania, and upper jaws; at one time perfectly transver, at another parabolic, or rounded in front, now forming an angle more or less acute, their symphysis is sometimes prolonged into a thin sharp point, as in the gar fish; and again as in the hemiramphes this point is prolonged, far beyond the upper jaw. The inverse, however, more commonly occurs.

In resuming the account of the bones of the face, we find eighteen or nineteen pairs constant, vid. one at the nasals, two at the upper jaw, seven in the palato-temporal apparatus, four in the opercular apparatus, and four or even five in the lower jaw, to which must be added the suborbitals, and the supertemporals, which in the perch form eight other pairs; and adding to these the bones of the cranium, we shall find for the whole head, a total of nearly sixty bones or thereabouts; but the subdivisions to which the superior maxillary is liable sometimes materially augment this number.

The Os Hyoides and Branchiostegal Rays. (a)

The three opercular pieces alone do not close up the great slit, one each side between the head and shoulder of the fish where the *branchies* are lodged; the closure is completed by the branchiostegal membrane which adheres to the *os hyoides*. This bone (pl. III. fig. vi. and vii) situated as in the other classes of vertebrated animals, but always suspended to the temporal. is composed of two branches consisting each of five pieces, vid. the small styloid (No. 29) which suspends it to the temporal* two large lateral pieces (Nos. 37 and 38) placed one behind the other, and forming the principal body of the branch (it is the posterior of the two (No. 38)† that is attached to the interoperculum); and lastly two small ones (Nos. 39 and 40) placed one above the other at the anterior extremity of the branch, and serving to join it with its fellow.‡ The lingual bone (No. 41) is placed in front of this junction, as in birds and reptiles, and behind in the angle formed by the meeting of the two branches, and beneath the *branchies*, there is an azygous piece usually vertical (No. 42) which represents *the tail of the hyoides*, so well known in birds and lizards.|| It is this piece, which, by joining itself to the symphysis of the humerals forms the *isthmus* which separates below the two openings of the ear. The *os hyoides* of fishes forms the total number of twelve bones.

* The style-hyal of M. Geoffroy.

† M. Geoffroy who thinks these two principal pieces are derived from the Sternum, calls the anterior *hyo-sternal*, and the posterior *hyposternal*.

‡ The superior of these two small pieces is called by M. Geoffroy *apo-hyal*, and the inferior the *cerato-hyal*, because he considers them as answering to the two first pieces of the anterior horn of the *os hyoides* in Mammalia.

|| It is this azygous vertical piece, that M. Geoffroy regards as analogous to the anterior azygous apophysis of the sternum in birds, and on which account he calls it *episternal*, but the episternal of birds is always situated behind the *fourchette* which is their small clavicle.

(a) A side view of the *os hyoides*, is represented pl. II. fig. vi., and plate III. fig. i.; and a view from above, with the bones of the *branchiæ*, pl. III., fig. vi.

The Radys (No. 43) which sustain the branchiostegal membrane, adhere by moveable articulation, often by simple ligaments, to the lower border of the two principal pieces of each branch,* the anterior are generally articulated to the border; the posterior are scarcely more than attached to the external surface, near the border. Their number and forms vary much; in the carp there are only three, and in elops there are more than thirty; the most common number at least in the acanthopterygians is seven, as in the perch.

This os hyoides can be raised and depressed, and carries with it the *branchi*, and even the lower jaw. When drawn by the widening of the palato temporal lamina, it can also render the angle of its branches more open, and thus enlarge, in concert with the operculum, the opening of the gills. The radys attached to it, have also their particular movements of widening and closing, and extend or fold the membrane which they support.

The Bones which support the Branchi.†

Fishes only breath by forcing out at the sides of their necks the water which they take in at their mouths; it thus passes between the *branchi*, which are a sort of comb, in general four at each side, formed of a great quantity of their narrow, forked, membranous or cartilaginous laminæ, placed in fishes after one another. These four pairs of *branchi*, are supported by four pairs of arches, adhering by their inferior extremities to the two sides of a chain of intermediate small bones, which chain is attached in front in the angle of the os hyoides, between the four anterior pieces and above its tail. These same arches become curved as they ascend, and fix their other extremity under the cranium, by cellular tissue, or ligamentous attachments only.

The intermediate chain of small bones forms a sort of continuation to the lingual bone. In general there are three‡ of these small bones; the first (No. 53)§ is attached in the bottom of the angle formed by the branches of the os hyoides; the second (No. 54 (*a*)) is behind the first, and affords attachment to the first pair of arches; the third (No. 55 (*b*)) and last, gives attachment to the second pair; the third pair of arches adheres to its extremity, and the fourth is attached in the angle of the third; lastly the inferior pharyngians are attached in the angle of the fourth.

The arches are composed, each of two parts, which are moveable on one another. The inferior is that which is attached to the intermediate chain of small bones, and in the three first pairs, is formed of two pieces, one internal shorter(*c*) (No. 57) the other external(*d*) longer (No. 58); in the latter pair there is but one piece (No. 60).

* These are the sternal ribs of Mr. Geoffroy.

† There is a view from above of the bones of the *branchi*, and the pharyngeans with the os hyoides, and in their natural position represented in pl. III. fig. vi.; and those of one side with the two parts of their arches extended, pl. III. fig. vii.

‡ M. Geoffroy regards them as articulations of the body of the hyoid.

§ The *Basi-hyal* of M. Geoffroy.

(*a*) The *ento-hyal* of M. Geoffroy.

(*b*) The *uro-hyal* of M. Geoffroy.

(*c*) The thyreals and arithreals of M. Geoffroy.

(*d*) The inferior pleurals.

The superior part (No. 61 (*a*)) much shorter than the other, is simple in all the arches, excepting the first pair, which having no superior pharyngean to support, is usually suspended to the cranium by a small style (No. 59) which we may, if we chose, consider the pharyngean of this pair.

The two parts of the arch are joined together by a cartilage which allows of movement, and form an angle which can be shut or opened more or less. These arches are attached to the intermediate chain by flexible cartilages so that the whole apparatus is movable, either opening or shutting the angle formed by the two parts of the arch, thus lowering or raising the back of the mouth, enlarging or narrowing in a vertical direction, the space between the branchi, or by carrying each arch more forwards or backwards, thus enlarging or narrowing the intervals between the branchi that give the water exit.

The external surface of the arches is hollowed for the lodgment of the vessels, which furnish branches to the cartilaginous laminæ supported on this surface, these laminæ constitute the essential part of the organ of respiration.

Their internal surface is furnished with small plates, cones, or bony laminæ, usually supplied with teeth, variously disposed according to the species, the most general use of which is to arrest such bodies as the fish swallows, prevent their being carried out with the water for respiration, and entangle them in the intervals of the branchial laminæ. These small pieces in their way, perform the same office, as the epiglottis in Mammalia, or the indented edges of the larynx in birds.*

In our perch for example, the arches of the first pair have an external row of these pointed and slender teeth like those of a rake, and an internal row in the form of small plates; the following arches have two rows of these little plates furnished with teeth like the pile of velvet.

Pharyngeal Bones.

The Pharyngeal bones are situated at the entrance of the œsophagus, immediately behind the branchial apparatus; their office is to effect a second mastication, often much more powerful than the first; for this purpose they are furnished with teeth, which vary much in number and form, according to the species.

In general there are two inferior and six superior. The inferiors (No. 56)* are attached behind the branchi in the angle formed by the two last arches; they often form two triangular plates which serves as a floor for the pharynx; sometimes, as in the cyprins, they are curved to surround a part of the œsophagus and sometimes as in the labrus and scarus, they are soldered into a single piece, or at least they are united by immoveable suture.

(*a*) The superior pleurals of M. Geoffroy.

* These small plates or indented points which cover the surfaces of these arches, are called *tracheals* by M. Geoffroy, who looks upon them as analogous to the rings of the trachea.

† M. Geoffroy calls them criceals, considering them analogous to the cricoid cartilage.

The superior (No. 62)† consist of three pieces on each side, which are attached under the internal extremity of the superior branches of the three last arches. The three of the same side unite in general in one plate, which forms with its fellow the vault of the pharynx.

The superior pharyngeal bones are adherent to the base of the cranium, and have but little mobility; but the inferior ones are raised or depressed with inferior branches of the arches, and thus dilate or narrow the entrance of the œsophagus,, at the same time, that they compress the food in its passage.

In the cyprins, the superior pharyngeal are small and toothless, a large concave prominence of the Basilar furnished with a plate of stony substance, fills up a part of the space which they usually occupy. Sometimes, as in scarus, there is but one pair of them; but we see in general the branchial and pharyngeal apparatus containing thirty-six osseous pieces, and if we counted those with which the arches are armed internally, this would amount to upwards of a hundred.

Vertebræ.

The vertebræ of fishes are known by the conical fossa, hollowed out of their bodies, upon the upper and lower surfaces. The double hollow cones which thus always occupy the interval between two vertebræ are filled up by a soft membranous and gelatinous substance, which passes from one space to another, through a hole with which each vertebræ is pierced almost always in its centre, so that these soft bodies form a sort of gelatinous cord or chaplet upon which the vertebræ are strung, and is alternately thin and bulky; it may even be remarked here, that in certain species of chondropterygians, as the lamprey, and partly in the sturgeon, the chimera, and the polyodon; this hole of communication is so large, that the bodies of the vertebræ may be considered as rings, and the cord which strings them presents inequalities in its diameter, and resembles a true cord, which name it has long borne in the lamprey. It is this circumstance that gave rise to the observation that the lamprey had no vertebræ; but it is an easy matter to see their annular portions, and even the bodies of the vertebræ may be detected with a little attention.

The vertebræ in fishes, as in other animals (*a*) have at their upper part, for the passage of the spinal marrow, an annular portion, from the top of which most frequently a spinous apophyse arises (*c, c, c,*) and in front andr ear of its base, small apoyhyses are found which correspond with the articular apophyses of other vertibrated animals, but which in most cases merely touch or encroach slightly on each other, without uniting by articular surfaces; they nevertheless are

* The Pharyngeal of M. Geoffroy.

† I have published the nature of the cord of the Lamprey, in vol. i. of the Mem. du Museum.

(*a*) In fig x. pl. iii. from 67 to 69, the different vertebræ are given by various surfaces.

moveable. Sometimes even, these articular surfaces exist on one side of the vertebræ and not on the other, so that they have nothing to articulate with. The annular portion of the first vertebræ is very often distinct from its body during the entire life of the first. In the others, they are either not separated, or they soon become conjoined.

In some fishes, as the muren, a part of the anterior vertebræ is distinguished below the body, by a little crest or vertical apophyse. In several also, the bodies of part of the vertebræ are soldered together; examples of this will be found in the cyprins, the silures, and the fistulaira, and instances still more strongly marked in many of the chondropterygians,

The vertebræ placed over the cavity of the abdomen (No. 67, 67) have transverse apophyses more or less strongly marked, which remain a long time, distinguished by sutures, and easy to be separated from the body of the vertebræ, as in the cyprins. In certain fishes, the hake, for instance, these transverse apophyses are very large, and give attachment to the natatory bladder. At one time the ribs are suspended by these apophyses; at another they are fixed behind them to the body of the vertebræ. In this respect there is a great variety.

In the vertebræ, of the back part of the abdomen (Nos. 68, 68) the transverse apophyses are in general prolonged, and directed downwards; the last of them are often united with each other by a transverse, thus forming a ring. There are some of these inferior rings running the whole length beneath the vertebra of the tail (Nos. 69, 69,) where they form a canal for the lodgment of the trunks of the vessels, in the same way, that the superior canal lodges the medullary cord. Besides these, there are in many fishes other transverse apophyses on the sides of the tail.

From these inferior rings of the tail, spinous apophyses arise (*b. b.*); but these are directed downwards, as those of the superior annular part are directed upwards, so that the vertebræ appears nearly the same in the two directions.

The inferior rings, like the superior often have a sort of articular apophyses, which are even sometimes large, and branched, thus forming round the vascular canal a kind of net work. This particularity is observed in certain species of the genus Tunny.

The vertebræ which approach the end of the tail, have their apophyses gradually shortened, their canal is narrowed, or closed; the last unite their apophyses together, and with the last interspinal small bones, thus forming with the last of all a triangular vertical plate (No. 70), to the posterior border of which are articulated the rays of the caudal fin (No. 71). Fishes that have long and pointed tails however, have not this disposition constantly; for instance, it does not exist in the eel; in others, such as the pike, this form still prevails.

The number of vertebræ, their relative length, breadth, and height, their furrows or fossettes that mark their bodies, the height and direction of their apophyses vary to infinity, and even frequently differ in a remarkable manner, in different parts of the same spine; but these details can only be glanced at till we come to describe species; we

shall then expose the singular structures of the anterior part of the spine in the ophidiæ, the cobites, the cyprins, the silures, the knots of certain choetodons, &c.; we shall at present confine ourselves to observing, that the number of the vertebræ is not always in proportion to the length of the fish.

*The ribs.**

The ribs (Nos. 72, 72) have in general only one head, they adhere each to a single vertebra, as in lizards, and the sternal portion is wanting, if we do not regard as such, in the fishes which have a kind of sternum, the scaly pieces that form it, or the aretes that join it.†

Frequently the ribs, or several ribs, have by way of appendage, one or two styles (Nos. 73, 73) adhering to some point of their length, which take a direction outwards, and penetrate the flesh; some of these styles, sometimes are given out from the body of the vertebræ above the rib, to penetrate into the flesh; it is in this manner that the crests in fishes are multiplied; a well known example of this is found in the family of herrings, whose entire flesh is traversed by crests as fine as hairs. The ribs themselves vary greatly; now slender and round, but more or less robust, now compressed, or in a form of a cythe, short, &c.

In certain fishes, such as the cyprins and herrings the ribs adhere to the vertebræ by means of a small intermediate bone, which is inserted into a lateral cavity of the body of the vertebra; and of which it forms a transverse apophysis, though capable of being detached from it.

As the ribs take no part in the respiration of fishes, their mobility in general is not considerable; there are species in which they enclose the whole abdomen, fixing themselves below in such a manner as to remain almost immoveable. Some fishes possess only the rudiments of ribs, in others they are entirely wanting; but the latter class is not so numerous, as it has been supposed.

Vertical Fins.

Supported by rays, as in the four members the vertical fins, of fishes can, however, only be compared, in other vertebrated animals to the ridges which elevate the back of certain lizards; still these ridges are but scaly and cutaneous fringes, but the rays of the fins belong in reality to the skeleton.

Each ray is composed of an internal part called the *interspinal bone* (Nos. 74, 74)‡ which penetrates into the flesh between the great lateral muscles. and serves as a sort of root,|| and of an external part (Nos. 75, 75) which is the *ray properly so called*.

* There is a drawing of a single rib, pl. iii. fig. 10, 72 and 73.

† We should recollect that M.M. Autenreith and Geoffroy professed to find the sternal rib in the rays of the branchiostegal membrane, but this is a mere hypothesis liable to dispute.

‡ M. Meckel calls them *accessory spinal apophyses*; these bones are represented in their different aspects, with the rays they support, pl. III. fig. x. from 74 to 79.

|| I know not why it has been stated that the interspinals are wanting in the *bichir*; like other osseous fishes, it has as many of them, as it has of rays or false fins.

We find frequently interspinal bones (No. 76) without rays, and sometimes also we see them supporting more than one. The form of this bone is nearly that of a four edged poinard, the point being buried in the muscles, and the handle on a level with the skin supporting the external ray. The part which supports the ray, has a transverse suture, which sends off from it a sort of epiphysis (a. a.). This epiphysis in several species produces a small point which passes into the articulation of the succeeding ray,

The interspinals are usually placed so that their points penetrate between the spinous apophyses of the vertebræ, and each point is attached by a ligamentous membrane before the extremity of one of these apophyses; but there are fishes, for example the pleuronectes, and for the anal fin, the silures, &c., in which we find two small bones for one vertebral apophysis, and others in which even these conditions are not regular.

It should be also observed that in many genera, such as the eels, the ophicephales and the gymnotes, the inferior interspinals are separated from the vertebræ by the cavity of the abdomen, which is prolonged above the anal fin; that in others, as in the pleuronectes, they are to be found as far up as the head. These circumstances, together with the fact, that in the parts of the back or tail which do not support vertical fins, there are usually no interspinal small bones although there are vertebræ, oppose our considering these bones as forming a part of the vertebræ, or dismemberments of vertebræ.*

The rays of the vertical fins (Nos. 74, 75) are articulated, each by a loose gynglimus, with an interspinal small bone. For this purpose their basis is generally divided into two small branches, each terminated by an articular tubercle, which enters into the lateral depression of the head of the interspinal small bone; between these two tubercles there is a small globular bone, on which the ray moves in two directions; but in the vertical plane their movement is more extensive; they can be elevated or laid backwards, thus raising the fin or diminishing its height. Sometimes these two branches are again joined below, and thus form a transverse ring, which entwines with a longitudinal ring of the interspinal, as may be seen in Nos. 76, 77.

A part of these vertical rays are pointed bones; they are called *needles* or *spinous rays*; the bases only of the others are bony and solid; but the rest of their length is made up of a multitude of little

* M. Geoffroy, (Memoirs of the Museum vol. ix. p. 97) thinks he has established that, the superior spinous apophysis of mammalia, which he calls *epial*, and which he supposes to be divided laterally into two parts, produces in fishes the interspinal small bone and the ray, because its two parts ascend one on the other: he employs the same reasoning with regard to the inferior rays, which he derives from the spinous prominence of the small bone *en chevron* from under the tail of mammalia; this small bone he calls *cataal*. But, independently of the other singularities of these views, the plaice which he took for example, was precisely the fish best calculated to set him right; for it has for each vertebra, two small inter-spinals, and two rays, and even the first vertebra of the tail, aided by the post-abdominal bone, attached in front of its inferior apophysis supports eight small bones and eleven rays of the fin of the anus: this may be seen in Duhamel, part II. sect 9, pl. 12. Another argument of equal weight against this system, is that every spinous or articulated ray is itself divisible into two halves, one on each side; whilst every interspinal is divided into two pieces, one superior, the other inferior.

articulations, most frequently ramified into a certain number of branches, which are again subdivided into other branches; they are called *articulate rays, soft, or branched rays*.

Very frequently, and perhaps always, these rays, even those we have just called simple, are divided longitudinally by a suture, into two halves, one on the right, the other on the left.

The rays of the caudal fin (No. 71) are always soft and articulated, but at its root above and below, it has small ones (Nos. 78, 78) which diminish insensibly in front, where the solid part of the base alone remains.

We may here observe, that the caudal fin has almost always, a ray less in its lower half than in the upper; but to this rule however, there are exceptions.

In a great number of fishes, the vertebræ at which the abdomen terminates, and the tail commences, and even the vertebræ following it, (Nos. 83, 83) have large inferior spinous apophyses, to which is joined a bone of more or less bulk, (No. 79), which descends to the back of the anus, thus limiting behind the cavity of the abdomen.

In the perch this is still a simple inter spinal, as our figures shew, (No. 79; but in other species it appears to result from a very large development of the first interspinal of the anal fin, or of the soldering together of some of the first of these bones: it is nevertheless a fact, that it fulfils a part of the functions of the pelvis.

The first interspinals, both inferior and superior, are in certain chætodons, swelled into thick knobs.

It is not necessary to enumerate in this place, the varieties in number, position, size, and length, of which the rays are susceptible. These circumstances may be observed externally, and serve even to give the character of species. We shall take notice of certain rays, which extend even on the head, by means of an inter-spinal, which lies flat on the cranium, and which in this position represent so many sorts of *panache*; these are seen in the lophius, in certain blennies, &c. We shall also remark that in some genera, principally of the family of the scombres, the spinous rays of the anterior part of the dorsal, and more frequently still a part of the soft rays of the dorsal and the anal, are not joined to the others by complete membranes, and they form what is called for the first, the free spines, and for the others, false fins. The sternum is deficient in very nearly the whole of the fishes; when it does exist, it forms a series of azygos bones, varying in their shapes according to the genera to which the ribs are attached. It is seen chiefly in the herrings and the vomers.

*Of the Shoulder and Arm.**

In the osseous fishes immediately behind the aperture of the gills, a series of bones is observed on either side, which circumscribes this aperture at the back part, forming a sort of jamb, on which the operculum falls when it closes.

These two series are most generally attached to the upper part of

* Independently of what is stated in general works, a special memoir on the shoulder of fishes by M. Geoffroy St. Hilaire, in the ix vol. of the *Annales du Museum*, p. 3, 5, 7, which is the origin of the researches of this learned naturalist

the head, and being united below constitute a bony girdle, which encompasses all this part of the body. The inferior symphysis formed by the union of these two series, has a ligamentous attachment to the tail of the os hyoides (42), and with that bone concurs in producing an isthmus, which separates the external orifices from the branchiæ of each side below, as the cranium intervenes between them above.

A small number of the osseous fishes only, such as the eels, have this girdle unattached above, and diminished in the number of bones.

When complete it consists of three bones on each side, which represent the shoulder and arm. To these are attached a group of two or three other bones, which are analogous to the fore arm, and have the pectoral fin as the representative of the hands. Lastly, a stilet is almost always suspended from it, formed of one or two bones, which appear to me to represent the coracoid bone.

The highest of these three bones (46) is usually bifurcated, and is attached by its apophyses to the two lateral crests of the cranium, (the intermediate formed by the external occipital No. 9 and the external formed by the mastoidean No. 12). Frequently a third apophysis penetrates farther in between the two crests. This bone shows itself outside, above the opening of the branchiæ, like a scale which is larger than the others, and some has its margin with indentations; it is deficient in some genera, as in the eels, and in lophius; it is united to the cranium by a fixed suture, as in the flying fishes and some species of silures.

The second of these bones (No. 47) is part of the margin; but it is wanting in the silures, in which species we find it soldered into a single piece, with the first bone. The third (No. 48) which is always very much the largest, completes the girdle as it proceeds, as we have already mentioned, to unite with its fellow from the other side beneath the throat. It frequently gives out above the base of the pectoral fin, a spine or indented angle, and generally is composed of two laminæ; between these laminæ, one of which is external, and the other internal, is a furrow in which the inferior fasciculus of the great lateral muscle of the body terminates, and which is moreover occupied by the muscles of the pectoral fin.

In the eels, this third bone takes the form of a simple cylinder compressed and arched. It remains still in some fishes that do not possess the pectorals, as for example, the Symbranchiæ, in which it is even very strong, and in which also we cannot find a trace of the second bone. But in the murena (*murena helena*), this third bone is no more than a long cartilaginous filament, which is only found in the flesh after a great deal of labour.

Almost always its union with that of the other side, takes place by cartilages or ligaments; but sometimes also as in the silures, and the genus platycephalus, the junction by a large indented suture.

on the osteology of this class. He has produced the greatest part of it in his *Philosophie Anatomique*, vol. i. p. 407, and the following pages.

We have figured the bones of the shoulder in their connexion with the cranium, by their external surface, pl. iii. fig. 1.; also detached from the cranium, but the union still remaining, the inside surface being presented fig. 1b., and fig. ii. these bones completely separate it.

To the internal lamina of this third bone, adhere a fourth (No. 51), and a fifth (No. 52), placed over each other, and each pierced by a hole, or laterally fissured, and thus maintained in connexion with the preceding bone. This fissure most commonly gives to the inferior of the two bones the form of a square. Their free side supports the pectoral fin, but it is by an intermediate range of four or five minute bones (No. 53), placed between these two bones and the rays of the fin, the first ray excepted, which is immediately connected with the superior bone (No. 52).

These minute bones recall to us most strikingly the recollection of the bones of the carpus; and, if this comparison be just, then the two pieces (Nos. 51, 52) to which the minute bones adhere, will represent, as we have before suggested, the ulna (No. 51), and the radius (No. 52).

The third bone of the girdle, the great inferior bone which supports the two latter, will correspond then necessarily with the humerus, and the first and second (Nos. 46, 47) will represent the scapula. In short, the scapula of several reptiles, particularly that of the frog, is manifestly composed of two osseous pieces, and even there the superior is frequently bifurcated, as it almost always is in fishes.

Henceforth we shall distinguish the two superior pieces of the girdle by the names *superscapulary*,* and *scapulary*†; the third will be our humeral,‡ and the two which bear the fin, shall be our ulnar and our radial.§

In some genera, but conspicuously in the salmons and in the cyprins, these two latter bones have, upon the internal side of their suture, a third bone, of which the extremity opposite to that which is attached to these bones, supports itself against the anterior border of the humerus, and thus acts as an arched buttress.

In the silures these three bones become very quickly soldered together, and even with the humerus, probably on account of the effort which they must make to support the very large spinous ray of the pectoral.

In the eels, where there are only two of these bones, they are in a condition, as if suspended to the point of junction of the scapular and humeral bones, and they are no longer to be seen in those species of fishes, where the pectoral is deficient.

A sort of stylet remains which is almost invariably composed of two pieces (Nos. 49, 50); the superior piece (No. 49), which is

* M. Bakker calls the superior bone the scapula, it is the omolite of M. Geoffroy. I have called it for a long time the pedicle of the shoulder.

† This is the scapulæ of Geoffroy, and the acromion of M. Bakker.

‡ Gouan calls this bone the clavicle. In point of fact it does perform the functions of one up to a certain extent, and M. Geoffroy has ultimately adopted this name. M. Bakker, considering it to be the clavicle and humerus incorporated, calls it coenosteon. M. Meckel calls it simply the clavicle, and so does M. Geoffroy.

§ These bones have been already called thus by M. Bakker. M. Geoffroy, however, takes our ulnar for a humerus, and does not speak at all of a radius, at least not distinctly. In lophius and polypterus he considers the bones of the carpus as those of the fore arm.

flattened more or less, is suspended to the bone (No. 48), which I have just compared to the humerus.*

This stylet proceeds downwards along the side of the body, behind the pectoral fin, and is prolonged more or less forwards into the flesh, so as to be taken for the analogue of the clavicle; but it is directed behind and seems to be rather a representative of the coracoid than of any other bone, for it is lost as it were in the flesh, having no large sternum to rest upon as its support, such as is seen in the birds and reptiles. Sometimes we find it joined to that on the other side, and even in the genus *siganus*,† and that of *saserinus* it is very strong; and reaches the origin of the anal fin.

An equally curious arrangement is that of the genus *batrachus*, in which the superior piece passes beyond the humerus above, and becomes attached to the upper part of the spinous apophysis of the first vertebra.

In the cyprins, on the contrary, the stylet is degenerated to a thin bone of a single piece, and it is wanted altogether in the eels, the sea wolves, and the silures.‡

Bones of the Carpus.

The little flat bones in fishes, which have been compared to the carpus (No. 64), adhere to the outside border of the fourth and fifth bones, which I have just called radius and ulna (Nos. 51, 52); they usually form a single row, and never exceed the number of four or five;§ but sometimes they are so shrunk in the middle that they look like two rows. Their office is to support the rays of the pectoral (No. 65), however numerous the latter may be, but with the exception of the first (No. 66), which is articulated immediately to the superior bone of the arm, or the radius (No. 52).

It is then the bones of the carpus, and not those of the arm, or fore

* I believe that I was the first to speak of this stylet, in my Lecture on Comparative Anatomy, p. 333. M. Geoffroy (*Annales du Museum*, vol. IX. p. 364) had compared it to half the fourchette of birds, the latter being, as I have proved it to be, their true clavicle, and my opinion is adopted by the greater number of anatomists. Still it is evident that it is altogether inconsistent with the position of this piece behind; indeed M. Geoffroy has corrected his opinion, and now calls it, in his *Philosophie Anatomique*, the coracoid bone; but he has not observed that it is almost always composed of two pieces. M. Bakker has been equally inattentive to this fact, although he concurs with us in the name of the bone; M. Van-der-Hæven, on the shoulder bone, is contented with making an extract from M. Geoffroy.

† For this interesting observation we are indebted to M. Geoffroy.

‡ M. Geoffroy supposes that he discovered the stylet in the first ray of the pectoral in the silures; that very ray which is spinous, and is actually united to the radius by a most singular articulation, described by us elsewhere. There is, however, no difficulty whatever in demonstrating, as we shall do in treating of this genus, that this is nothing more than a ray, and even an articulated ray, and which would appear to be spinous only because its articulations are soldered together. The little bone, again, which he considers as the analogue of the stylet in *silurus electricus*, is nothing else than the third bone of the fore arm, of which we have spoken in the preceding page.

§ M. Van-der-Hæven, page 67, according to M. Geoffroy, *Annales du Mus.* vol. IX. p. 365—368, states, that the bones of the carpus are wanted in certain fishes, or are confounded in them with those of the rays. I do not think that this occurs in any osseous fish whatever.

arm, which are elongated and form at the surface certain kinds of arms, in the genus *lophius* where there are only two, in that of *batrachus* where there are five, and in the *polypteræ* where there are only three.* Under these circumstances the ulna and radius are very much reduced.

Bones of the Posterior Extremity.

The os innominatum, the thigh, the leg, and the tarsus on each side, are represented by merely a single bone (No. 80), generally of the form of a triangle, but more or less complicated with apophyses and protruding layers.† The apex of the triangle is before, and in the fishes denominated by Linnæus *jugular* and *thoracice*, that is to say, in my *Subbrachians*, this apex or the apophysis which replaces it, are attached to the symphyses of the bones, which we have called humerus. In the true abdominal fishes it remains free in the flesh.

The posterior side, which is usually the narrowest, gives attachment to the rays of the ventral fin, to the internal side of which rays it often gives another apophysis behind (*bb*). Almost always the internal side is united to that of the corresponding bone by suture (*aa*). Sometimes it happens that these two bones remain separated from each other, either before as in the genus *lophius*, or behind as in that of *batrachus*. Every body is acquainted with the fact that very many fishes, such as the eels, the electrical eels, the sword-fishes, &c., are utterly destitute of ventral fins, while others, as the *lepidopus*, are furnished only with very imperfect traces of these fins. In the former case there is no vestige whatever of a pelvic bone.

The Rays of the Extremities.

The rays of the extremities without being so symmetrical as those of the vertical fins, are divided in the same longitudinal direction, each into halves. They are almost always, the whole of them, articulated, with the exception of the external ray of the ventral in the *acanthopterygians*, but their base is more compact than the remaining part of their length, and the articulations are invisible or nearly so. This base is increased in such a manner as that it is able to form a solid attachment to the bones of the radius, of the carpus, and of the

* M. Geoffroy (loc. cit.) has supposed that the two long bones which sustain the pectoral in *lophius*, are the bones which he calls radius and ulna in other fishes; but this is certainly not the case; the two bones which we consider as the bones of the fore arm, are found in their natural situation in this genus as in all others, and the two great bones, which form the pedicle of the fin, are some of those which we refer to the carpus. M. Bakker adopts the idea of M. Geoffroy; he has adequately estimated the difficulty, but has been unable to solve it. M. Meckel considers this bone precisely as we do. In the *bichers* (*polypterus*) there are three bones which are lengthened out to support the pectoral, and the pieces of the base of the rays form, in these animals, a second row to this description of carpus. M. Geoffroy has taken the two extremities of these three bones of the carpus, for the radius and ulna. The same bones are lengthened in the *platycephalus*, *periophthalmus*, and other genera, in which it is impossible not to distinguish the bones of the arm before the latter.

† M. Bakker calls this coxa. It is represented plate III, fig. 8. by the superior surface, and fig. 9, by the inferior.

pelvis. We rarely find the first ray of the pectoral ramified, and its joints are sometimes so soldered together, as to assume the appearance of a spinous ray, as happens in the silures amongst other fishes. The same thing happens likewise to one of the first rays of the dorsal in the cyprins, silures, &c.; so that these are by no means true spinous rays, notwithstanding their appearance; and, in point of fact, these fishes, by every character which they have, belong to the malacopterygians.

The first joints of the pectoral or ventral rays are lengthened out sometimes, as in the bichir, and in such a way as to represent a second row of carpal bones, and also a row of tarsal ones.

It is unnecessary for us to occupy ourselves in this part of the work, with the difference in the number and proportion of these rays; they may be easily known from descriptions of the exterior parts.

We have now furnished a detail of the elements which constitute the skeleton of the common or osseous fishes, and it is to be remembered, that under this last denomination we embrace, as has already been stated, a good number of the fishes to which the title of cartilaginous had been given by our predecessors, in consequence of their bones being less completely ossified, as the genus *lophius*, the tetrodons, and balistes, &c. Except the vertebræ and the rays of the fins, there is scarcely any difference in the number and connexions of the above elements, and it is only to the differences between their respective forms and proportions, that we are to assign the incalculable varieties of the general form of fishes. One set of bodies we find lengthened out, other sets are either globular or prismatic, or horizontally flattened, or so compressed laterally as to resemble disks or edged lamina; another group of heads we find to be absolutely monsters in growth, and they are angular in shape and bristled, then there are others, the proportionate insignificance of which is so very singular, the snouts are both short and large; those which are prolonged into an apex or into a sword, have almost always the same number of bones in their composition.

But the chondropterygians, the only fishes which I place in a grand division in relation to the combined effect of their organization, very considerably differ from others in the skeleton, and we are obliged to speak of them separately. What we now give is only an abridgement, as we reserve ourselves until we come to the history of these fishes, to present to the reader the details of their anatomy.

Summary view of the Skeleton of the true Cartilaginous fishes called Chondropterygians.

The pieces of this skeleton in the selacians, that is to say in the rays and sea-dogs, do not assume at all the fibrous tissue which characterises the bones, the inside part remains always cartilaginous, and the outer surface is indurated by very small calcareous granules, which are collected on it, and which give to it the dotted appearance by which they are distinguished.

This is the reason, in all probability, why the cranium of these fishes is divided by no sutures, but is composed of one continuous

case, modelled besides, and pierced very nearly as the cranium is in the common fish, so that this head of the chondropterygians is capable of being separated into the same regions, the same fossæ, the same eminences, and the same foramina, but is not composed of bones so capable of being separated.

Their face is also extremely simple. There are only two bones to their palato-temporal arch, the first proceeding downwards from the cranium to the articulation of the jaws, the second holding the place of the superior jaw, and supporting the teeth, whilst the maxillary and the intermaxillary are degenerated to very trifling traces which are concealed in the thickness of the lip. Neither has the lower jaw more than one bone also on each side (the articular) which supports the teeth, and there only remains of the others a slight vestige which is also hidden beneath the skin of the lip.

The opercular apparatus is wanted; but that of the hyoid and the branchiæ has a good many characters in common with the same apparatus in the osseous fishes. Besides, there is in the sea-dogs, opposite the external attachment of each branchia, a thin bone suspended beneath the integuments, which is the true rudiment of a rib, but is very different from the branchiostegal rays that are considered in the osseous fishes as sternal ribs. The branchial apparatus is placed farther behind in the chondropterygians than it is in the osseous fishes, and it is that which so much draws back, beneath the origin of the spine, the girdle of the shoulder.

The latter which is attached, in the rays, exclusively to large apophyses of the spine, but which is free from any adhesion in the squalus is a single piece only, in these two genera, and it surrounds the body, and supports on each side a greater or less numerous row of other pieces, which form a base for the pectoral fin, and also for the borders to which the rays adhere.

The pelvis, in the same way, is only a single transverse piece, which does not articulate with the spine, and supports, on each side, a lamina or stem to which the rays of the ventral adhere. This is the stem which is continued in the form of a mass in the males, and in them assumes a very complicated sort of structure, respecting which we shall have more to say, by and by.

There are portions of the spine in which several of the vertebræ are soldered together, or, at least, in which the space where they are to be laid is occupied only by a tube of a single piece, pierced on each side by numerous foramina for the exit of so many pair of nerves. Such is the origin of that of the rays. In the latter also, and in the squalus we may observe, that there are just twice as many superior rings as there are vertebræ. Independently of the common annular portions, there are others which correspond to the joinings of the vertebræ altogether.

The spinal ribs, whenever they exist in fishes, are usually very small, and in the rays, these ribs are much more so than those of the squalus. The sturgeons have very considerable spinal ribs.

In respect of the structure of the branchiæ, the sturgeon is a medium between the two genera just mentioned, and the common fishes; many of the bones of the head, and all the bones of the shoulder being

indurated and quite stony on their surfaces, but not at all fibrous. On the other hand, the cord passing through the axes of the bodies of its vertebræ are not affected by any shrinkings, and this circumstance approximates it to the lamprey.

In the latter genus, the whole of the parts of the skeleton are more simple still than in the selacians; its spine especially is much softer, and it is destitute of branchial arches. Its branches adhere to the interior only by the medium of a membranous canal; on the contrary, externally, there is an apparatus formed, by these descriptions of ribs, the earliest vestiges of which have been shown in the squalus, and in the present case are branchy, like a sort of cage.

The ammocetes have even no cartilaginous skeleton. All the parts, of their frame-work permanently remain in the membranous state, and thus in reference to their peculiar condition, will resemble much more the worms, than they will the vertebrated animals.

The Chimæra likewise has the cord of its spine stronger and better marked than the body of the vertebræ, and on the fore part, a number of annular pieces is superseded by a crest of a single piece; in the polyodon too, the cord is exceedingly vigorous.

All these varieties in the skeleton of the Chondropterygian fishes will be more clearly explained when we come to their particular joints, and can enter into the necessary details.

CHAPTER IV.

MYOLOGY OF FISHES.

Movements of the Skeleton in Fishes.

The spine composed of an indefinite number of vertebræ, with the motion which their uniting cartilages allow them on each other, bends freely from right to left, in one or more curves alternately convex and concave, according to its length. It would be equally pliant in the vertical direction, did not the superior and inferior spinous apophyses limit this movement in the ratio of their height and their approximation to each other.

It is therefore chiefly in striking the water laterally by the alternate flexions of its body and tail, that the fish moves forward. The surface which thus strikes the water, is augmented or lessened in height, according as the fins of the back, the anus, and the tail, have their rays more spread and erect; this is effected by the mobility of the rays on the small interspinal bones, with which they are articulated, which mobility, according to the form of the articulations, takes place forwards, backwards, or to the sides, at the will of the fish, producing the same effects as a rudder.

As to the fins which are in pairs, the pectorals in the first place, possess the movement of the girdle of the shoulder, which takes place from before backwards, or from behind forwards, to an extent that depends on the freedom of the articulation of the scapula, and on the

existence or absence of the sternum, but which in general is very limited. The bones of the arm are seldom endowed with any particular mobility. Even the carpus enjoys a separate movement only in the species in which it is prolonged. But all the rays have the power of receding from or approaching towards each other, and the fin which is composed of them, has the faculty of moving forward, or of lying flat against the body, or of raising, depressing, and inclining differently its plane to the horizon. It acts on the entire fish much in the same way as a wing placed in the same situation, and its strength depends on its surface, and the vigour of its muscles.

We know that, in the pirabebes and the exocetus, the pectoral fins are large enough to lift the fish out of the water, and to enable it to describe in the air an extensive curve.

The ventral fins follow the motion of the bones of the pelvis, which move forwards, backwards, and to the sides, and, when not soldered to each other, they recede from or approach each other. They have also a power of expanding or contracting their rays, a combined movement towards the vertical or the horizontal plane, by being drawn towards the belly or the sides; they thus act like oars.

Lastly the head is slightly moveable on the spine, and largely on the jaws, the palato-temporal arches, the os hyoides, the branchial arches, the pharyngeal bones, and the opercula. The opening or closing of these parts, so useful in deglutition and respiration, contributes also to the motion of the fish forwards, by the pressure which the water sustains from them in its passage backwards through the mouth, to be ejected by the openings of the branchiæ.

To these different movements we should add that which the body of the fish receives in the vertical direction, from the greater or lesser degree of compression which the ribs exert on the natatory bladder. This bladder placed under the spine of the back, and filled with air, according as it is more or less compressed or dilated, gives to the fish a specific gravity, equal, superior, or inferior to that of the water, and thus enables it to remain in equilibrium, and either to descend or ascend.

It now remains to explain in this chapter, the muscles which impart the different motions just described, to the osseous organs.*

We shall first describe the great muscles which act on the entire body; then those of the vertical fins; we shall then speak of muscles of the fins in pairs; and lastly, we shall examine those complicated

* The myology of fishes has been still infinitely more neglected than their osteology. In Gouan's history of fishes, page 69 and following, there is a meagre description of the most external muscles taken from an acanthopterygian, possibly a *sparus*. Vicq. D'Azyr has given some unfinished sketches of the myology of the chondropterygians, and the eel (second Memoir on fishes, Acad. des sc.: Sav: etr.: vol VII.) M. Dumeril and myself have considerably extended them, in my lectures on comparative anatomy, vol I. *passim* for the body and members; vol. III page 90 for the jaws, and vol. IV. page 353 for the branchiæ and their opercula; but still our descriptions have not all the clearness and generality desirable. Those now given are new, and are taken from more numerous observations; as in the rest of this anatomical treatise, I have taken the perch as the principal type; the most remarkable exceptions will be noticed in their proper place.

muscles which move the different parts of the head, and its several apparatus on each other.

The muscles of fishes, like those of other vertebratæ are composed of fleshy fibres of a more or less deep red colour, and of tendinous fibres of a silvery or white colour, in similar respective positions. But it may be affirmed, that with the exception of certain particular muscles, which are sometimes of a deep red, the flesh of fishes is paler than that of quadrupeds, and especially than that of birds. There are even species, whose flesh is purely white; its odour and savour are different; it exhales more infection during decomposition, an infection of a particular character which has been compared to that of phosphuretted hydrogen gas, but which, according to M. Chevreul, depends on a particular principle.

*Great lateral Muscles of the body.**

Essentially there is but one great muscle on each side, (No. 1) filling up the space from the head above, and the bones of the shoulder below, down to the sides of the base of the caudal fin. But this single muscle is very complicated, and represents the three fasciculi of the sacro spinal, which, as fishes have no necks, extend from the tail to the head, without presenting those distinctions, which obtain in other animals, between the cervical portions, and the dorsal and caudal portions.

The muscle of one side is separated from the other, by the spine and its apophysis, by the deep seated muscles of the interspinal small bones (Nos. 3 and 4) and by the ribs which surround the abdominal cavity. They separate from each other below (*in a*) to make room for the pelvis, to which they often furnish, each a small fasciculus, and for the ventral fins. Farther forwards (*in b*) each is divided into two, for the passage outwards of the pectoral fin, and the muscles that belong to it.

The superior portion of this anterior division, is inserted chiefly into the cranium (*in d, e*) the bones of the shoulder (*in f, g*) and in many species, even to that part of the humerus, which is above the pectoral (*in, h*). A part of it stops at the first rib, and from the point a fasciculus, (*y*) sometimes, is sent to the mastoid bone, which we might compare to a scalenus. Its inferior portion is inserted into the inferior part of the humeral bone (*in c*) and particularly to its symphysis. Below, it is continued to the body or the azygous piece of the hyoides (*from c to d*). It is this prolongation which occupies what is called the isthmus. This inferior division of the great muscle envelops the stiliform bone behind the shoulder (*in a, b*) nearly in the same way, as the vestige of the clavicle is enveloped be-

* The muscles of the Perch have been represented in plates IV, V, and VI of the osteology of fishes: plate IV. is the external lateral layer; plate V. the deeplateral layer. In pl. VI. is represented the upper layer of the muscles situated below the head and chest; fig. II. are the muscles under the cranium and internal surface of the branchiostegous membrane; in fig. III. the muscles which are proper to the branchiæ; the heart is also in its situation. It is to these three plates that the references in the present chapter are directed.

tween the great pectoral and the sterno-cleido-mastoid, in carnivorous quadrupeds, or at least, this bone is attached to its surface, by dense cellular tissue.

These two great muscles are divided, transversely, by aponeurotic laminæ into as many layers of fibres as there are vertebræ. These layers, when detached by cooking (which dissolves the gelatine of the tendons) gives to the flesh of fishes a foliated appearance.

These aponeurotic laminæ, and the fleshy leaves which they mark, are disposed more or less obliquely to the spine, and generally curved so that their superior (*i k, i k*) and inferior (*l m, l m*) parts are directed obliquely from behind forwards, the former ascending, the latter descending, and their middle portion (*k l, k l*) forms an angle, or an arch more or less convex, with its convexity directed forwards. The muscle is thus divided lengthways into three bands. When we cut into the superficial layer, we find that the superior band is easily separated from the middle one; and in removing the superior band from the bones at its inferior border, we observe that its deep-seated and inferior part is attached to the spinous apophyses of the vertebræ by tendinous threads which take a direction obliquely backwards. If we separate it superiorly from the spinous apophysis, and interspinal bones, we find that its superior deep-seated part also gives oblique tendons to the spinous apophysis, but which have a direction obliquely forwards. Its more superficial part sends sometimes, also, in the places where there are dorsal fins, to the interspinals of those fins, especially to those of the needles, straps which are similarly oblique, and directed forwards. It is this band which seems to us to represent the spinal muscle of the back.

The middle band would appear to us to represent the longissimus dorsi, that which is called in quadrupeds with tails, the lateral lumbo-sub-caudal. As the pelvis does not here interrupt the continuity of the muscles of the tail, with those of the back, there is no further distinction, excepting in the neck. Superiorly its deep seated portion furnishes oblique slips, directed backwards to the sides of the spinous apophyses of the vertebræ. Throughout the rest of its height, its deep seated fibres pass from one rib to another, drawing them together like the intercostals.

The third band, appears to me to correspond in the part which is under the tail, to the inferior lumbo-sub-caudal of Mammalia; but in all the part which runs along the abdomen, it performs the function of the abdominal muscles, especially in the species in which the ribs do not cover the entire cavity. Its union with the middle band is much more intimate, than that of the superior band.

Along each flank, in the middle of the height of the fish, and consequently on the middle band of the great lateral muscle, there is a slight furrow, in which a mucous vessel is lodged. It corresponds to the extremities of the accessory ribs; but it does not penetrate deeply, nor is there in this place any separation between the muscles, at least, in the majority of fishes having compressed bodies.

This, however, is not always the case. In the eel for instance, the situation of this furrow marks the principal solution of continuity, so that the laminæ of the superior band have the form of a V open in

front. In the trout, there are three solutions of continuity nearly equally well marked, the two ordinary ones and a middle one.

In fishes with depressed bodies, the superior and inferior bands are horizontal and parallel to each other; in these the inferior, still more obviously, performs the functions of the abdominal muscles.

The great lateral muscles terminate behind by an aponeurosis, which is inserted by tendinous slips in the base of the rays of the caudal, which it laterally supports. Even some of the small muscles belonging to this fin are inserted into this aponeurosis; it also conceals its deep seated muscles. The superior and inferior bands are inserted more particularly in the extreme rays, and seem to concur in separating them from the others, and dilating the caudal.

The use of the great lateral muscles is obvious: each of them bends from its side the whole or part of the body of the fish, and consequently all impart to it those alternating motions of flexion and extension which carry the fish forwards; for it is by the strokes which the tail and to a certain extent the whole body, give laterally to the water, that the fish moves in this direction. The anterior inferior portion which goes to the symphysis of the humeral bones, and thence to the body of the os hyoides, representing the sterno, and cleido-hyoideans, concurs with the genio-hyoidean, which we shall notice in the sequel, in bringing down the lower jaw, and consequently in opening the mouth. As the head has no muscles proper to it in osseous fishes, it is to the great lateral muscles, that it owes the slight movements which it executes. This, however, is not the case in the chondropterygians in which the head is furnished with muscles proper to itself.

The Thin, Superior, and Inferior Muscles of the Trunk.

In the interval of the two great lateral muscles, either at the back, or more frequently also at the belly, there are two thin muscles, which commonly are only interrupted by the dorsal and anal fins, to the anterior and posterior bases of which they are attached; they move these fins, but they also serve to curve the trunk, either upwards or downwards, whenever the disposition of the vertebræ renders such movements possible.

In the perch, whose dorsals commence at the nucha, there is but one superior pair of these muscles, and they can only be seen between the second dorsal and the caudal (No. 7); but inferiorly, there are two pairs, one (No. 6) proceeding from the posterior part of the pelvis to the anal, embracing the anus; the other (No. 8) extends from the anal to the caudal, and corresponds with the dorsal portion (No. 7).

In fishes which have but one dorsal more or less short, as in the cyprins, there are two pairs on the back, and when there are two dorsals separated from each other, as in trouts, there are three pairs; but when there are two or three dorsals in contact, and occupying a large portion of the back, as in the cods, the muscles of that side are considerably reduced in size.

The same variations obtain with regard to those of the belly.

In the abdominal fishes, whose ventrals are remote from the pectorals, there are three well marked pairs; one proceeding from the

humeral to the pelvis; another from the pelvis to the anal; the third from the anal to the caudal; they are also well seen in the trout. Sometimes, as in the cyprins, the first pair is intersected by tendons, and is attached more or less to the lateral muscles. In certain species with depressed bodies, the lophius for example, the inferior muscles are not distinguished from the inferior portion of the lateral muscles, which have themselves the appearance of the abdominal muscles.

Muscles proper to the Caudal Fin.

There are three descriptions of these muscles; the first series are superficial, the second deep seated, the last proceeding from one ray to another.

The superficial (Nos. 11, 11) partially adhere to the aponeurosis which terminates the great lateral muscle of the body, and by which this muscle is inserted into the caudal. The small muscles which this aponeurosis supports, spread out like a fan, to be inserted obliquely into a greater or lesser number of rays.

Those which pass from one ray to another (Nos. 12, 12) are situated between their bases, and take a direction more backwards than the preceding ones.

The deep seated muscles (Nos. 9, 10) can only be discovered when the great lateral muscle is removed. They adhere to the end of the spine, particularly to the vertebræ, compressed into the form of a triangle which terminates it, and supports the caudal fin; the one is superior the other inferior. They may be often separated into two layers: their insertion into the bases of the rays, is made by slips concealed under those of the terminal aponeurosis of the great lateral muscle.

Sometimes, particularly in the perch, there is a third muscle (No. 13), which arises from the middle of the height of the vertebræ, between the two preceding ones, and which ascends to the superior part of the fin: it must then co-operate with the superficial muscles and those between the rays in contracting the fin. The deep-seated muscles as well as the large lateral muscles must support it on the side.

The Proper Muscles of the Dorsal and Anal Fins.

The description of these muscles is extremely simple, in consequence of the strict uniformity of their arrangement, and because each of the rays has six, or in other words, has four deep-seated, and two superficial muscles.

The superficial muscles (Nos. 2, 2, 2) are inserted in the ring at the sides of the base, the one to the right and the other to the left; they are placed as layers on the large muscles of the body, in a manner which is transverse to their direction, and are attached to the skin. Their length, and the power which they possess are by so much the more considerable, as the fish avails itself of the resource furnished by its vertical fins to strike the water right and left, and as the motion of the rays in this direction has greater freedom. The perch, which we have selected as the object for our representations in the plates, is furnished with such as have a moderate degree of length.

The deep seated are concealed to a great extent between the two large muscles of the body; they adhere to the interspinous small bone, two before (No. 3), and two behind (No. 4), the one being separated from the other by the crests of this small bone, and inserted at the base of the ray, which they can elevate or depress behind, or even carry from the side when the anterior and posterior of the same side act in unison; but the latter description of motion is invariably but slightly marked.

Muscles of the Shoulder.

The girdle which forms the shoulder of fishes, and which is composed of the bones called by us supra-scapular, scapular, and humeral, is susceptible of merely a very circumscribed faculty of motion; and, indeed, it may be regarded rather as a fixed point for those of the trunk, the branchiæ, and inferior jaw. Nevertheless, if we suppose that these other parts should be themselves fixed for an instant, then this girdle may be drawn backwards by the great lateral muscles of the body (No. 1), of which it receives a considerable portion.

It is justifiable, likewise, to represent the shoulder as deriving motion forwards, from the part of this same muscle (*d, c*), which goes to the body of the os hyoides, where a fixed point for it to act upon is given, when this bone is brought nearer to the jaw by the genio-hyoidean muscle, and when the jaw itself is closed by the crotaphites.

There is in some species a muscle, which, on the posterior, inferior, and lateral side of the cranium, is carried to the superior and anterior part of the humeral bone, and which partly invests the membrane that performs the office of a diaphragm between the cavity of the branchiæ and that of the body. It must act on the shoulder but very feebly, and its destiny more probably is to act on the diaphragm and to compress the intestines. In the perch it does not extend (No. 10), except from behind the mastoidean to the supra-scapular and scapular.

The coracoid stylet has not what may be exactly called a peculiar muscle, but, as before mentioned, it is encased in the great lateral muscle of the body. Sometimes, it merely gives attachment to a thin and oblique muscular layer, which partially covers this great muscle.

Muscles of the Pectoral Fin.

In the large number of species where the carpal bones are small, these muscles are only inserted in the rays.

On each surface there are two layers all of which terminate by as many long tendinous slips as there are rays. The direction of the two layers on each surface is a little crosswise. The anterior superficial layer (No. 14) comes from the humeral bone and descends, whilst the deep seated layer (No. 15) arises from the external surface and the inferior edge of the ulnar bone; it ascends. This arrangement is the inverse of that of the posterior layers, for in the latter the layer nearest the bones descends, whilst the other ascends. When the two layers of the anterior surface act in unison, they

support the fin before, or, in other words, they place it in an angle with the body which is more or less wide, the two posterior layers bring it nearer and stick it against the body. Each layer, by its independent action, may raise or depress the fin according to its direction. Sometimes a process is detached from the deep posterior layer which, carrying its tendon over the superior border, becomes a special elevator of the fin: it is by the combination of these various actions that the pectoral extends or contracts. In those species in which the carpus is prolonged, as in the lophius, these special muscles are much more developed.

These are the layers of which we at first spoke, and which being enlarged gradually in the squalus, become at last the enormous muscles of the wings of the ray, that form the greatest proportion of the edible flesh of this fish.

The Muscles of the Pelvis.

The bones which support the ventral fins, and to which we have applied the name of bones of the pelvis, are put in motion forward and backward by the lower thin muscles of the trunk (No. 6) already spoken of. The anteriors proceed from the internal extremity of the humeral bones, and are inserted into the inferior surface of the bones in question near their internal border. The posteriors are connected to the posterior border of the bone of the pelvis, and directing themselves towards the anus surround that aperture, and are either lost amongst the lateral muscles, or become attached to the first interspinals of the anal fin. The anteriors are sometimes subdivided. In that species which have the ventrals attached beneath the throat or thorax, they are very short, and are very intimately united with the great lateral muscles.

These bones of the pelvis are moved towards one another by transverse muscles, placed beneath their inferior surface, of which one part is occasionally crossed; but they do not invariably exist. The perch, for instance, has none; and it is probable that they are not to be found in any of the species, where the bones of the pelvis are united by a suture. On the other hand, we find them very large in the lophius, where these bones are separated from each other.

The pelvic bones receive from the large lateral muscles, between which they are situated, a slip which draws them from the side; but, generally speaking, their motions, as well as those of the two bones of the shoulder, are very much limited.

Muscles of the Ventral Fins.

They are supported by the bones of the pelvis; the depressors on their lower surface (Nos. 17, and 18); the elevators on their upper. Two layers on each surface, crossing one another a little like those of the pectorals, separate into as many slips as there are rays, and are more or less distinct, as those rays are more or less separated and have the power of motion more independent. The more external of the slips (No. 17), are more generally separated, and serve to dilate the fins.

These proper muscles of the rays of the extremities, both of the

pectoral and of the ventral fins, may be compared to the short flexors and short extensors of the toes of the lizards, and especially the crocodile; animals in which these parts are usually in the same way disposed in two layers, on each surface of the hand and foot, but more defined and assisted by long muscles, which are entirely wanting in the fishes.

Muscles of the Jaws.

These compose one single mass (No. 20), which is common to the two jaws, and which closes the mouth by bringing the latter together.

The mass is connected with the whole external surface of the posterior portion of the palato-temporal arch, and with all the bones of which it is composed, including the anterior edge of the preoperculum. It is most usually divided into three tubercles or bellies, and sometimes four; its form is very nearly quadrangular, and from its anterior border it gives off two tendons united by a single apophysis. That which is sent off by the superior angle, and which is the longest, reaches the upper part of the superior jaw; that coming from the opposite angle, which is much shorter, is inserted into the lower jaw behind its coronoid apophysis. The aponeurosis dilates itself on the membrane which joins the two jaws.

This organization, it will be seen, is very different from our crotaphyte and our masseter; but we shall find it constant in all the osseous fishes, and in some of them we have never been able to detect any thing which could be said to resemble the pterygoidean muscles. As to the cartilaginous fishes, the muscles of their jaws present some important distinctions, which will be described in the proper place.

A difference not less remarkable, is the absence of a digastric, or of any representative of that muscle, for depressing the lower jaw; the jaw does not move in that direction, and, consequently, the mouth can only open by the simultaneous action of the muscles between the shoulder and os hyoides, and between the latter and the lower jaw.

This last muscle (No. 27) answers to the genio-hyoideus and we shall return to it.

But the lower jaw in fishes being able, in numerous species, to approximate more or less, the two branches is furnished with a proper muscle destined for this office (No. 21). It is placed across the angle formed by the two branches and behind their symphysis, above the anterior termination of the genio-hyoideus.

Muscles of the Palato-Tympanal Arch.

There is one muscle always occupying a considerable part of the palatine arch; it is a very thin layer of tranverse fibres which pass from a part, more or less extended under the sphenoid and the great wing, tranversely to the superior border of this arch and its internal surface, being inserted chiefly in the temporal, and the adjacent part of the box and internal pterygoid. This muscle depresses the arch, and brings it to its fellow, a circumstance that contracts the lateral space for the branchial apparatus.

Another depressor, larger and more extended, is sometimes farther behind, and appears beneath the lateral part of the cranium, before the depressor of the operculum; in the perch this is wholly a slight sub-division.

The elevator of this same arch, (No. 24), arises behind the orbit beneath the edge of the posterior frontal, and before the elevator of the operculum; it is inserted into the upper part of the external surface of the temporal, and into a portion of the external pterygoid. It is the antagonist of the former, it draws the palatine arch, and dilates the space destined for the branchiæ.

We find then, that the palatine arch, composed of bones which we have called palatine, pterygoid, internal, external, jugal, box and temporal, has motion by its two articulations, the one anterior belonging to the palatine, the other posterior attached to the temporal, and its motion consisting of a drawing away of its inferior part from that of its fellow, or of an approximation of them; a motion which draws away also the branches of the lower jaw and the opercular apparatus, dilating at the same time the whole of the branchical apparatus.

This is an action indispensable to the process of respiration, and which is cotemporaneous with the life of the fish.

Muscles of the Operculum.

The motions of the operculum are very like those of the palatine arch, and the muscles engaged in these motions are situated behind those of the latter arch. There is also an external one (No. 25), which raises the operculum, and another internal (No. 26), which depresses it,

They are divided sometimes into several bellies: and in some species the elevators form two or three distinct muscles.

The elevator (No. 25) is attached chiefly along the external crest formed by the mastoidean bone; the depressor (No. 26) is connected with the inferior lateral surface in a part where the great wing and petrous bone are united together and to the mastoidean. It is separated from the depressor of the palatine arch (No. 24), by the fasciculus of superior anterior muscles of the branchiæ.

The suboperculum and interoperculum have no proper muscles; they participate in the general motions made by the palato-temporal arch, and by the operculum properly so called.

It is proper in this place to remark that the muscles which approximate the branches of the hyoid, and contract the branchiostegal membrane also contribute a part in bringing together the palatine and opercular apparatus.*

Muscles of the Os Hyoides.

The principal, (No. 27), answers to the genio-hyoidean; it departs from the internal surface of the branch of the lower jaw near the symphysis, and supports itself on the sides of the hyoidean branch, into

* Quite as important a remark is this, that there is no analogy whatever between the muscles of the operculum, and those of the minute bones of the ear in the mammalia.

the first of the great pieces of which it is inserted. Very frequently transverse fibres unite the two genio-hyoideans into a single mass, at least in their middle part, as is exemplified in the perch. A transverse muscular band often unites one branch of the hyoid with the other, but the perch has nothing like this. As for the remainder, the muscles between the rays of the branchiostegal membrane act also as a direct agent in bringing together the branches of the hyoid; nor ought we lose sight of that portion of the great lateral muscle of the body, (No. 1), which is directed to the body of the hyoid, and performs the function to it of a sterno-hyoidean.

Muscles of the Branchiostegal Membrane.

There is generally a layer of fibres (Nos. 28, 28) placed transversely on the internal surface of the branchiostegal rays, occupying more or less space, according to the species.

A part of these fibres arises from the internal surface of the operculum, towards its base; but some of them also arise from the suboperculum: they pass over the rays, adhering to them only by cellular tissue. They thus form a sort of purse round each of the branchial cavities, which is complete in proportion to the smallness of the branchial opening, sometimes those of one side unite with those of the other, under the isthmus, wholly as in eels, or in part, as in the cyclopterus, or lophius: sometimes even as in eels, they are joined by a raphe to the body of the os hyoides, and in general to the inferior anterior part of the trunk; but when the gills are well split, these communications from one side to the other do not exist. However, there is often a pair of very remarkable muscles which, crossing each other, pass from the inferior ray of one of the membranes to the anterior extremity of the opposite branch of the hyoides (Nos. 29, 29); they stretch the membrane, and draw it towards that of the other side. As to the fibrous layer which is placed over the rays, its general effect is to bring them nearer to each other, and to contract the branchiostegal membrane.

There are also small peculiar muscles to each branchiostegal ray, which have their other attachment to the neighbouring part of the branch of the os hyoides, and which, according to the species and the direction, contribute to dilate or contract the membrane; but their existence is not constant. They are not found in the perch; but they are easily observed in the lophius and cyclopterus.

Muscles of the Branchial and Pharyngeal Apparatus.

These muscles may be divided into several groups, some suspending this apparatus to the cranium, some to the spine, some are attached to the humeral bone, and others to the body of the hyoid; finally some of them are proper to the apparatus, and unite its parts with each other.

A first fasciculus is attached to the cranium, between the depressor muscle of the palatine arcade, and that of the operculum, to the part of the great wing, and of the petrous bone, which lies under the

articular fissure, which the posterior frontal, and the mastoidean, present to the frontal.

The fasciculus is divided into two orders of ribbands, four external and two or three internal.

The four external (Nos. 30, 30) are inserted into the back of the superior pieces of the four arches of the branchiæ; the internal into the two first pharyngeans.

These muscles raise the superior part of the apparatus, and draw it towards the cranium; at the same time, the external carry the arches forwards, and dilate the intervals of the branchiæ.

A second fasciculus is attached to the cranium, behind the depressor muscle of the operculum, and is connected to the extremity of the mastoidean bone.

It is composed of two ribbands, an anterior one (No. 32) which goes to the superior piece of the fourth arch, more outwards than the last of the externals of the preceding fasciculus, and a posterior one (No. 33) which terminates in the tissue of the pharynx, behind the third superior pharyngean.

The functions of this second group are nearly the same as those of the first.

A third fasciculus consists of one muscle only, which is considerable (No. 41, pl. vi. fig. iv.) and which commences at the internal and posterior border of the third superior pharyngean, and passing across the fibres of the pharynx, proceeds obliquely to attach itself to the spine.

This muscle carries the entire apparatus backwards, raising it at the same time as the two preceding fasciculi.

The superior part of the second arch has a particular muscle attached to the side of the base of the cranium, nearly on the junction of the great wing with the Basilar, and which passing horizontally is inserted into the arch before the insertion of the external fasciculus which this arch receives from the first fasciculus.

The action of this muscle is to draw the two rows of arches nearer to each other, and to the axis of the base of the cranium, in which they are seconded by the transverse muscles proper to the apparatus, which we shall describe by and by.

Three muscles act on the apparatus by means of the inferior pharyngean in which they are inserted.

One of them (No. 35) comes from the superior crest of the body of the os hyoides, above the insertion of the great lateral muscular. It proceeds to the pharyngean ascending obliquely behind; and drawing it downwards and forwards, acts as an antagonist to that which is attached to the spine.

The two others (Nos. 36, 37) go off from the humeral bone, No. 36 from its inferior part, and ascending upwards; No. 37 from its middle part, and it goes almost horizontally; No. 36 lowers the apparatus by drawing it backwards; No. 37 simply draws it back.

The pericardium, and the heart, are placed between these three muscles, and their fellows on the opposite side.

The muscles proper to the apparatus, are the transverse and the oblique. The latter amount on the inferior surface to the number

of four on each side, and proceed from the azygos chain of small bones to the inferior portion of each arch. The effect of their action is to depress this part.

The transverse superiors (No. 39) are three, and are sent off from each pharyngean to the adjacent part of the arch. The latter is common to the pharyngeans, and to the arches of both sides.

There is only one inferior (No. 40) which is thick, and is between one pharyngean and the other.

The latter two muscles are employed in bringing together the pharyngeans, and in contracting slightly the apparatus in a transverse direction. The same effect is produced by the first, up to a certain extent.

This description of the muscles of the branchiæ, which is chiefly derived from the perch, applies to a large number of acanthopterygians; it does not however extend to all fishes, except with such modifications as are of importance for the number and direction of the ribbands belonging to the various fasciculi—modifications which depend, as is very obvious, on the general form of the head, and on the difference in size of the pharyngeans, as also on the functions in which they employ the various sorts of contrivances wherewith they are armed. We shall see some examples of this in the course of the present work.

But the differences which are more essential in their nature are those observed in the chondropterygians. Their branchial apparatus has no operculum, and is surrounded with a general muscular envelop, that is frequently reinforced by a sort of ribs. We shall give a description of them in detail, when we come to this grand division of the class of fishes.

So far as regards the analogies of these muscles, all that can be said is that the fasciculus of suspensors has some relation with the stylo-hyoideans and stylo-pharyngeans of man, and that the transverse superiors can be compared to the hyo and to the crico-pharyngeans; but these are affinities so very remote as that they cannot be allowed to establish an undoubted analogy.

CHAPTER V.

Brains and Nerves of Fishes.

AFTER having described the mechanism of their motions, we now pass to the system of the nervous organs of fishes, or to that contrivance by which this mechanism is put into action.

This system is composed, as is the case with the superior tribes of animals, of external senses, of a central medullary apparatus, and of nerves which establish their communication. As, again, in the higher orders, the central medullary apparatus, that is to say the brain and spinal marrow, occupy the cavity of the skull and of the vertebral canal.

*The Brain.**

The most striking feature which we recognize in surveying the brain of fishes is its extremely small size, not merely in reference to

* The brain of fishes has been studied and described with a little more attention to detail than their muscles, and in modern times the distribution of the nerves has been investigated with care.

In 1685, Collins gave some figures of a certain number of fishes; the designs were of very moderate merit, and the explanations were all shallow, and not very consistent either. Pl. 60 is a squalus, pl. 61 a white ray; in pl. 62 another ray, the thornback, and an angel fish; pl. 63 a cod, a lamprey, a trout, and an ombre; pl. 64 a carp; pl. 65 a barbel, a plaice, a dab, a flounder, a sole and turbot; pl. 66 a flounder, a perch, a gudgeon, and an eel; pl. 67 a dory, a smelt, a herring, a fish called a gurnet, but which I do not believe to be a real one; pl. 68 an orphie, salmon, mullet, and a mackarel; pl. 69 a pike, tench, and perch. His pl. 70 represents the commencement of the spinal cord of a mullet, a gurnard, a carp, a pike, and gudgeon.

In 1761 Camper in his Memoir on the Scaly Ear of Fishes, printed, in 1762, amongst the memoirs of the Society of Harlem, gave a description and figure of the brain of the cod, and in 1762 in a Memoir on the Ear of Fishes in general, printed in 1774, in vol. vi. of those of learned foreigners of the Academy of Sciences, he described and represented those of lophius and of the ray. He was the first who determined its parts, and he gave the name of hemispheres to the hollow lobes placed before the cerebellum, and tubercula quadrigemina to the little eminences which they enclose; the inferior lobes appeared to him to be the corpora albicantia.

In 1766 Haller, at the end of vol. iv. of his Physiology, gave a description of the brain of the carp, and the same year he sent to the Harlem Academy a memoir on the brain of birds and fishes, inserted in 1788, in vol. iii. of his *Opera Minora*, p. 191. In this work he describes those of the carp, a cyprinus, a tench, a ferra, of a trout from the lake of Geneva, and from that of the Alps, of the grayling, the perch and ling. His descriptions are very detailed, but it is exceedingly difficult to comprehend them, in consequence of the singular way in which he has applied names to various parts; and also because there are no figures. He calls the anterior lobes, anterior olfactory tubercles; those beneath inferior olfactory tubercles; the hollow lobes before the cerebellum, optic thalami; still he gives the name cornua ammonii to the large tubercles of their interior, and at the very time that he acknowledges that the cerebellum is analogous to that in quadrupeds, he calls the lobes next the cerebellum the cannulated bodies, and that of pineal gland to the globule which is between them in the cyprinus. These denominations are by no means fortunate, for the author never meant to convey the notion that there was an agreement of parts.

In 1776 Vicq d'Azyr in his two memoirs on the anatomy of fishes printed amongst those of learned foreigners presented to the Academy, has inserted some observations on the brains of fishes, and represented but very indifferently those of the conger, the eel, those of a labrus, of the otter pike, of the plaice, and the turbot. He does not appear to have had very determined ideas on the names of the parts.

In 1785 Monro in his anatomy of fishes, gave, pl. 34, a very good figure of the brain of the ray, but what he says in his text p. 44, respecting the brain of fishes in general amounts really to nothing.

Figures of the brain of the pike, the carp, and silurus, the names of the parts being adopted from Camper, appeared in a thesis by M. Ebel, entitled *Observations neurologicae ex anatome comparata*, published in 1788, and reprinted in 1793 in the *Scriptores neurologici minores* of Ludwиг, vol. iii.

It was on the authority of these different authors that I published in 1800, in my Lectures on Comparative Anatomy, vol. ii., my description of the brain of fishes. Adopting the example of Camper and Ebel, I have there considered the middle lobes as the true hemispheres, the tubercles which they contain, the quadrigemina and the inferior lobes have appeared to me to be the optic thalami. I have given in vol. v., figures minutely representing the brains of the carp, eel, and moon-fish, I have also

the proportion of the body, but in comparison with the mass of nerves which it gives off, and with the cavity of the skull in which it is lodged.

communicated in that work several general facts relating to the distribution of the nerves; and those of the head and adjacent parts in the carp are also represented.

In 1813 M. Apostole-Arsaky, in a thesis supported by him at Halle, *De cerebro et medulla spinali piscium*, has represented the brains of the conger, the sword-fish, the hake, the motella, the star-gazer, the ribband-fish, the scorpena, the dory, the sole, the moon-fish, the sparusrail, the sargus, the sparus salpa, the boops, the saurel, the mullet, the grondin, the white shark, the zygana, the scyllium, and the ray. This is the richest and the most correct collection of this genus. The author in this work considers the hollow lobes immediately before the cerebellum as the analogues of the tubercula quadrigemina, and those which are placed before the latter as representing alone the hemispheres.

In 1817 M. Weber in his *Anatomia comparata nervi Sympathici*, printed at Leipsic, gives again the brain of the carp, and continues to call the hollow lobes hemispheres; but it is in the azygos lobe or cerebellum that he thinks he sees the analogue of the tubercula quadrigemina, and he calls the lobes behind the azygos those which border and cover the fourth ventricle. In 1820 in his treatise *De aure et auditu hominis et animalium*, he represents also the brain of the carp, and adds to it that of the silurus. Independently of these, we are indebted to this skilful anatomist for important discoveries respecting the Neurology of fishes, but especially for that of the superior longitudinal nerve, which he believes is always given off by the fifth pair, but to which also the eight very often contributes.

The same year M. Fenner in a thesis published at Jena, *De anatomia comparata et naturali philosophia commentatio etc.*, clings still to the notion that the true brain is in the hollow lobes, and he places the optic thalami in the inferior lobes.

The same year also M. G. R. Treviranus in a memoir on the brain, inserted in the third volume of the collection which he published in conjunction with his brother, gives also his theory of the brain of fishes. The anterior lobes appeared to him to represent the olfactory bulbs of the brain in the mammalia; the hollow lobes anterior to the cerebellum, in which, as he calls them, the posterior hemispheres are analogues of the posterior parts of the optic thalami, but he attributes to them the functions of the brain itself; the tubercles which they contain are the quadrigemina; the inferior lobes, the corpora albicantia. Thus, it will be seen, that Le separates himself very little from M. Camper, and his followers.

The Academy of Sciences proposed, on my solicitation, as the subject of one of their prizes for 1821, a comparative description of the brain, throughout the four classes of vertebrated animals, and this was a direct excitement to fresh investigations.

The author who obtained the prize, M. Serre, published his work in 1824, in which he describes and represents the brains of the ray, the white shark, the angel fish, the spotted-dog-fish, the sturgeon, the conger, the eel, the cod, the whiting, the haddock, the turbot, the sole, carp, barbel, tench, pike, perch, gurnard, and lophius. His figures are unfortunately executed with the greatest negligence. From the large volume and the cavity of the tubercula quadrigemina in the fœtus of the mammalia, he is induced with M. Arsaky to regard the lobes anterior to the cerebellum, as the analogues of these tubercles, and the brain generally, as a complete representation in most respects of that of the fœtus in the higher animals.

M. Desmoulins, who had also contended for the prize, published in conjunction with M. Majendie, a work more extensive in its nature than that which he had transmitted to the Academy. He describes in the second book of this work, vol. 1. p. 140—183, the cerebro-spinal system of fishes, and furnishes many observations on their various nerves. His descriptions are illustrated by representations of the brains, and detached portions of the nervous system of the thornback, of the rough ray, torpedo, lamprey, several of the sharks, of the sturgeon, moon-fish, of two mullets, the otter pike, the barbel, the carp, the cod, the whiting, the ling, the lump fish, turbot-carp, and conger. He adopts with M. Serre the ideas of Arsaky on the different lobes.

It does not at all fill the cavity, and the interval between the pia mater which nearly binds it, and the dura mater, which lines the interior of the cranium, is occupied only with a loose cellular tissue, or a sort of arrachnoid, that is frequently impregnated with an oil, or even sometimes, as in the sturgeon and the tunny, with a very compact fat.

It has been observed that this space between the cranium and the brain is much less in the young fishes than in the adult ones, a proof that their brain does not grow in the same proportion as the rest of their body, and we have actually found its dimensions very nearly the same in species in which one was, in other respects, double the other.

The lobes composing the brain are placed in succession, and represent very often a sort of double chaplet. There are also tubercles, and these sometimes are pretty numerous, which are hidden in the interior or beneath one of the great lobes*.

To come to the knowledge of the analogy between these various lobes and tubercles with those of the brains of the other classes, we must first start from a fixed point, and this we shall make the cerebellum. (*a*, pl. VI, fig. V. VI, VII, and IX).

This is a portion respecting the nature of which no misunderstanding can arise, for it is characterized by having no fellow, and having its position across the upper part of the spinal marrow, and is joined by the sides so as to resemble a bridge.

In front of this cerebellum may be seen without dissection, on the superior surface, a first pair of lobes (*b, b*, *ib.*) the interior of which is permanently hollow, and which are preceded by one and sometimes by two other pairs (*c, c*, *ib.*) which are generally solid. In the interior of the hollow lobes upon their floor, and in front of the cerebellum, are often one or two pairs of small tubercles (*d*, *ib.*, fig. IX). At the inferior surface, there are, under the hollow lobes, another pair of protuberances (*e, e*, *ib.*, fig. VIII), which we call inferior lobes; and between them, in front, is suspended an azygos body (*f*,) which corresponds to what is called the pituitary gland. Behind the cerebellum are other lobes (*g, g*,) different in number and formation, of which the superior class offers nothing except its vestiges, and which we call the posterior lobes.

Certain anatomists take the hollow lobes for the hemispheres of the brain, the lobes placed too far in front for the analogues of the olfactory protuberances of the superior class, and the inferior lobes to be analogous to the optic lobes of birds; others consider the inferior lobes as analogous to the mamillary protuberances of the mammalia, the hollow lobes as those of the optic lobes of birds; they place the brain, properly so called, in the anterior lobes, notwithstanding their minuteness and simplicity, and seem inclined to admit only the olfactory protuberances in the lobes which sometimes precede them there, or

* The brain of the perch is represented in its natural situation, with the nerves of the head and shoulder, pl. VI, fig. V; it is figured separately by its superior surface, *ib.*, fig. VI; laterally fig. VII; from below fig. VIII. At figure IX, the plate represents the hemispheres opened, and the cerebellum put aside after having cut one of its connections. The superficial nerves of the body are represented with the muscles Pl. IV (the first of Myology) and the deep seated nerves Pl. V.

rather which are sometimes distinguished from them by a constriction.

Before deciding between these opinions, it is necessary to enter into larger details upon the form and composition of these parts, and upon the principle variations which they undergo in different species.

The relative size of the cerebellum (*a*) is also considerable, and it often surpasses in volume the parts situated in front of it; its lateral lobes either do not exist, or only form very slight protuberances.

In osseous fishes, for example in the perch, its form is frequently that of a soft cone, the summit of which is curved backwards, nearly like an inverted phrygian hat; and nevertheless there are, also, some like the mackarel, in which its summit bends forwards; and others, as the tunny, in which it extends backwards and forwards in such a manner as to receive all the remaining part of the brain.

In the chondropterygians, it assumes very different forms and volumes; sometimes it is almost reduced to a transverse bar, as in the sturgeon and lampreys, sometimes round or oval, or lobed, and very voluminous, as in the ray, and more especially in certain squalus.

Its surface is sometimes transversely furrowed, particularly in several of the squalus and the tunny, and even when it is smooth, as is generally the case, there is seen in the interior of its substance a medullary axis, which gives out ramifications of the same nature in the cortical substance, and which is hollowed by a cavity that communicates with the fourth ventricle.

The hollow lobes (*b, b*) placed immediately before the cerebellum, and upon the nature of which there are different opinions, are of an oval form.

In the greatest number of osseous fishes, their envelope presents two layers, often very easily separated, the external one is grey, the internal one white.

The fibres of the external layer, obliquely directed from behind forwards, terminate for the most part in the optic nerve; but they co-operate in its formation with other fibres arising, some from the inferior lobe, others from the medulla oblongata, and some even, as may be seen in the rays, from the anterior lobe.

The fibres of the internal layer of the hollow lobe, much more easily discovered than the others in osseous fishes, are directed transversely, and line the arch of the common ventricle enclosed in the hollow lobes.

They appear to arise from a semi-circular pad (*h h*, fig. ix), of greyish matter, which occupies on each side the base of this ventricle, as the fibres of the roof of the hemispheres in the human subject rise from notched bodies.

The arches of the hollow lobes unite in a median line, which forms a species of callous body, and a ridge projecting inwards; but there is no complete septum.

Upon the floor of this ventricle are seen (in the osseous fishes) two or four tubercles of a greyish substance (*d*, fig ix.) and placed before the base of the cerebellum upon the aqueduct, which leads from the ventricle of the hollow lobes into that which is under the cerebellum, and at its posterior, which corresponds to the fourth ventricle in the higher classes.

The number, forms, and relative proportions of these tubercles vary according to their genera.

In certain fishes, as the carp, the anterior pair is long, and directed backwards, being bent like a ram's horn.

In others as the mackarel, the posterior pair is greatest; it forms a curve forwards, and appears to fold itself like an intestine.

In the tunny there are as many as three tubercles on each side, some placed beside others, and resembling so many folds of intestines.

These are wholly wanted in the chondropterygians where we can no longer trace distinct fibres on the inner surface of the hollow lobes.

In the greater number however of fishes, especially in the perches, pikes, herrings, cods, &c., the internal tubercles amount to four, varying but little in size.

The nerve of the fourth pair arises behind the hollow lobes, the tubercles which they contain, and the furrow which separates them from the anterior base of the cerebellum; sometimes it arises a little on the side, but not at all below, as has been represented.

It is difficult to trace the medulla oblongata in its course towards the anterior portions, and to see it passing, after leaving the cerebellum, by its more external fibres into the hollow lobes (*b, b*), and by its more internal ones into the anterior lobes.

These latter lobes when they are not perfectly soldered together, as often happens in the rays and squalus, communicate with each other, at least by one and sometimes two commissures (*k*). The proportion between them is various; very commonly they are smaller than the hollow lobes; they are very large in the eels: but in the rays and squali their superiority is quite enormous.

The ganglions or tubercles (*i, i*) which are sometimes before the anterior lobes, these lobes being sometimes found to be two pairs, as in the eels, are not joined to one another by a commissure, but each is united to the lobe before it; and we are enabled to trace the olfactory nerve beneath the inferior surface as far as the commissure (*k*) of the anterior lobes (*c, c*).

There is always a commissure (*m*) for joining the anterior portions of the base of the two hollow lobes; and it is behind this and before the four tubercles contained in these lobes, that the ventricle opens, which is analogous to the third ventricle in man, and which leads as usual to the infundibulum, and towards the pituitary gland on the inferior surface of the brain.

The two lobes (*e, e*) which we have called the inferior, are seen at the sides of the infundibulum. They are generally tolerably large, of the shape of a kidney, and a ventricle is seldom found in their interior.

When however, it is found, it communicates with the third ventricle, and through it with the great ventricle which is common to the two hollow lobes.

The inferior tubercles (*e e*), furnish very evidently the fibres of the optic nerve, and behind them, and also in the furrow by which they

are distinguished from the remainder of the medulla oblongata, the nerve of the third pair arises.

These appear to me to be much larger in the surmullet than in any other species of fish, they are excavated by a ventricle, and their surface is furrowed.

The name to be given to the pairs of lobes just described, and which are situated in front of the cerebellum, will depend on the relative importance that may be attributed either to the complication of their structure, or to their being the origin of the optic nerve.

If we attend to the origin of the optic nerve, it is certain that we shall find an analogy between the hollow lobes and this external pair of lobes of brain in birds, to which latter the name of optic thalami has been given, but which are stated by M. Gall to be the analogues of the tubercula quadrigemina.

But if we attend to the structure of the hollow lobes, to that semi-circular part (*h*), a sort of notched body forming the internal base of their envelope, and from which the tranverse fibres of their roof are given off, then if we attend to the position of the third ventricle, to that of the commissure (*m*), placed before the opening of the ventricle, and which necessarily corresponds with the anterior commissure of the brain, with the small tubercles (*d*) hidden in their interior, and which so closely resemble by their position, figure, and relations the tubercula quadrigemina of the mammalia; if all those are carefully attended to, we shall not fail to recognize in them, the whole of the characters that are essential to the brain of the vertebrated classes.

This analogy will be confirmed if we make a comparison between the above parts, and such of the mammalia as have the anterior portion of their hemispheres, from which the olfactory nerve immediately arises, separated from the rest by a furrow sufficiently deep, and representing the anterior lobes of fishes (*c*, *c*).

The tortoise, toad, and several other reptiles, will likewise confirm this view. The olfactory lobe of their brain resembles the anterior lobes of fishes, and their brain the hollow lobes of the latter. It has the same bodies analogous to the notched ones, the same commissures, the same entrance for the third ventricle, and for the infundibulum. But in the reptiles the tubercle, analogous to the tubercula quadrigemina are large and hollow as in birds, approximated to each other above as in quadrupeds, and visible externally, whilst in the fishes they are at the same time, as in quadrupeds, solid, approximated to each other, small and hidden, by the hemisphere which is supported behind as far nearly as the cerebellum.

It is useless to make the remark, that in the embryos of quadrupeds and birds, the hemispheres are almost as small, and the tubercula quadrigemina as great, in proportion as the interior and hollow lobes of fishes. The hemispheres in them are not therefore solid masses, and the tubercles, although hollow, do not present in their interior, notched bodies and other tubercles, still smaller. It is not under them that we find the anterior commissure of the brain, nor are they intercepted by the third ventricle. In the reptiles which have been also collected for comparison, it is true as we have already said, that

the optic tubercles are hollow as in the birds. But the hemispheres are also hollow and contain a notched body, and in a word, resembles in every point the hollow lobes of fishes; indeed, so strong is the resemblance, that they have also before, a set of solid lobes, which are their olfactory lobes.

A more plausible argument is drawn from the position of the pineal gland.

But in reality this part is not seen in a great number of fishes; still it would be difficult not to see in the eel, and especially the conger, a small globular body of grey substance, placed anteriorly to the hollow lobes and inserted into the posterior base of the solid lobes before them by two small slips.

In the cod and other fishes, where there is no globule, we can detect at least, a small medullary thread floating in this place.

If these parts represent the pineal gland and its pedicles, we shall then be obliged to confess, no matter what system of analogy we adopt, that there must be in the brain of fishes, at least, a transposition of connected parts. The third ventricle and infundibulum must be flung into the back ground in the hypothesis, which represents the hollow lobes as the analogues of the tubercula quadrigemina, and the pineal gland must be brought forward in the hypothesis which considers these lobes as the hemispheres.

With respect to the inferior lobes (*e, e*) since they manifestly give out a portion of the fibres of the optic nerves, I considered them formerly as the analogues of the optic lobes in birds, which would have descended still lower than the flying class; but other anatomists prefer the conclusion, that they are the analogues of the corpora albicantia of man and other mammalia, eminences that are wanted in birds and reptiles, and which, if this opinion were true, would abruptly appear again in the fishes, and much larger in size than in the mammalia.

I must confess, that I am not a convert to the arguments in favour of such allegations, and I have witnessed in the scale of living beings, very little of those returns to life, of organs which suddenly spring up in some single class, after having disappeared in one or two of those above it in the scale.

One peculiarity of the brain in fishes, not less remarkable than all the preceding, consists in its lobes (*g, g*) being situated behind the cerebellum on the sides of the fourth ventricle, forming frequently as the cerebellum itself, a bridge across the ventricle.

Their proportions vary very much, and the differences of their forms and connections are numerous.

In the rays and squalus, and even in the sturgeon, there are folds or slips which prolong on each side the posterior edge of the base of the cerebellum, and are supported behind in bordering the fourth ventricle.

In most fishes, they consist of two tubercles or projections from the sides of the spinal marrow behind the cerebellum, which are touched at some point, or are united by a commissure.

In the cyprins, their volume is considerable, covering the whole of this part of the spinal cord. Two small bosses are distinguished in

front, one being placed in the middle, whilst the lateral portions are transversely striated.

I found them also very considerable in the surmulletts where their surface is marked by tortuous furrows, like that of a brain.

In the gurnards we have seen as many as five bosses on each side, arranged in a row, rounded, occupying a space that extends as far as the second vertebræ, and which is just as long as the remainder of the brain. From the latter of these tubercles, the second pair of spinal nerves is given off, it terminates in the three rays which in this genus are attached beneath the pectoral.

These lobes have been compared to the little greyish band which, in mammalia, is placed across the *corpus restiforme*, or medullary cord, which passes behind the cerebellum to the medulla, and bordering on each side the fourth ventricle; but it must be admitted, that this would be a prodigious developement of them.

In the bottom of the fourth ventricle, slight longitudinal furrows are observed, which already mark the division of the medullary fasciculi, the external of which proceed to the hollow holes, and terminate at the swelling (*h, h*), which I have called the notched body; the middle ones are continued as far as the anterior lobes (*c, c*). We see here, also, the lineaments which seem to indicate the origins of the nerves of the fifth, seventh, and eighth pairs.

There is nothing below, bearing a resemblance to the *pons varolii*; but furrows are visible, which appear to distinguish the fasciculi just mentioned. The middle ones represent the *corpora pyramidalia*; but the fibres do not appear to be crossed. There are no *corpora olivaria*, unless we wish to search for them in the tubercles above the medulla (*g, g*), but in that case they would be much higher than in mammalia. On the side of the medulla are seen the restiform fasciculi, which terminate at the cerebellum.

The pituitary gland (*f*) is situated as usual, under the brain, at the extremity of the infundibulum. In fishes, it is generally large and accompanied by membranous and vascular appendages of various forms. In the Ray, these appendages are particularly remarkable. Sometimes, as in the lophius, the aigrefin, &c. the infundibulum is prolonged to a thread, and the pituitary gland is placed far in front. The same obscurity with regard to its use exists in fishes as in the other classes of animals.

The Nerves and Spinal Marrow.

The olfactory nerves (*a a*) come from the anterior tubercles (*c, c*) and very often we find again a swelling at their root (*i, i*): they vary much in size and composition; sometimes merely capillary, sometimes thick though single, and sometimes double, triple, or composed of threads more numerous, which form a bundle. In many fishes, they swell to the size of a ganglion before they are distributed to the pituitary membrane, and it has been remarked that this happens chiefly in the species where there is no swelling at their base, in front of the anterior lobes.

The optic nerves (*n, n*) cross each other in front of the infun-

dibulum (*f*), and in most fishes without uniting or sticking to each other, their connexion being by mere cellular tissue.

In the perch, or the cod for example, it is easy to uncross them and see that the nerve of the right eye comes from the left side of the medulla, and *vice versa*. But in the Ray their union is so intimate, that their crossing is as problematical as it is in mammalia.

In a certain number of osseous fishes, their structure is very remarkable, inasmuch, as their medullary substance is no more than a large thin ribband folded longitudinally to fill the tube with which it is furnished by the *dura mater*; but there are other fishes in which it is composed as usual, of a bundle of nervous threads.

We have already pointed out the origin of the third (*p*), and fourth (*q*), pairs.

The fifth, or trigeminal nerve (*r*), arises from the sides of the fourth ventricle, below and close to the anterior part of the lobes (*g*), placed behind the cerebellum, or the crura of the cerebellum itself. The roots of it can be traced more deeply and in different directions.

The origins of the eight pair, or par vagum (*t*), which are almost as considerable as those of the fifth pair, are behind the latter; they arise most frequently in several filaments which come out on a single longitudinal line, on the sides of the medulla, under the lobes behind the cerebellum; they form a ganglion (*t*), after which they are subdivided.

Between the fifth and eight pairs, we recognise the acoustic nerves (*s, s*), and there is usually, in front of the eighth pair, a particular nerve (*v, v*), which answers to the glosso-pharyngeal. The ninth pair is not found in fishes.

The spinal nerves, reckoning from the tenth pair, arise as in the superior classes, from the spinal marrow by two sets of roots; but they do not always arise near the foramina in the vertebral column, through which they pass. There are even species, such as the Moon-fish, in which the spinal marrow is so shortened as to seem to be no more than a small conical prominence of the brain, from which the different pairs of nerves go out as from a horse's tail.*

In others, such as the lump-fish, it is prolonged and swelled opposite each pair. In general, it does not terminate till near the end of the spine. The nerves of the superior roots have scarcely any sensible swelling as a ganglion in the chondropterygians; it has been even denied that they have any swelling whatever in osseous fishes. It is, however, certain that they form sufficiently well marked ganglia in the Bar, the Perch, &c.

The first pairs of spinal nerves are collected more or less into a plexus, to be sent off to the pectoral fin. In the Ray, in which the fin is so enormous, it receives nerves from many other parts of the spine.

The great sympathetic nerve (*xx*, fig. iv.) derives its roots, as usual, from the different spinal nerves, and forms divers plexuses and ganglia in its distribution to the viscera. In general, its tenuity

* It is utterly wrong, as Arsaky and others on his authority have said, that there is nothing like this in the lophius; its spinal marrow measures almost the whole length of the spine, but it is enveloped and concealed by the nerves, which arise much higher than they go out.

is extreme, and even some have attempted to deny its existence in the chondropterygians; but this is an error, for I have seen it very distinctly in the Ray. In the Moon-fish, its ganglia are tolerably large. It can be traced in the head as far as the nerves of the fifth pair; but hitherto its junction with the sixth has not been made out with sufficient distinctness. I believe, however, I have seen it in the cod.

The distribution of these different nerves is particularly remarkable, on account of its resemblance to what takes place in the superior classes. Each pair has the same destination: the first supplies the organ of smell; the second, by its expansion, forms the retina of the eye; the third, fourth, and sixth, go to the muscles of the eye, each to the same muscles, as in quadrupeds, or birds: that is the third supplying nearly all the muscles; the fourth the obliquus superior; the sixth the abductor. The third also penetrates into the interior of the globe, furnishing the filaments of its choroid membrane; but it appears not to form an ophthalmic ganglion, at least, it has not been hitherto discovered.

The fifth and eighth pairs are the most important, and those which are distributed to the greatest number of different parts.

The fifth comes out of the cranium through a foramen of the great wing, which is frequently divided into two by a small bony slip. Its division into branches (pl. vi. fig. v.) occurs in its course, according to the species; but it uniformly gives, first, an ophthalmic branch (α), which, ascending through the upper part of the orbit, goes to the nostril, and is distributed to the adjacent parts to the top of the snout, and to the intermaxillary bone; second, a superior maxillary branch (β) which passing beneath the eye, is distributed to the cheek, and superior maxillary bone; it sends a branch towards the nostril, and anastomoses with the pterygo-palatine; third, an inferior maxillary branch (γ) which is often only a division of the preceding, giving twigs to the posterior part of the palate, and terminates at the lower jaw, and at its dental canal; frequently the threads of the palate are supplied by a particular branch; fourth, a pterygo-palatine branch (λ), which passing forwards, traverses the bottom of the orbit, under the muscles of the eye, and following the direction of the vomer, passes between this bone and the palatine, to terminate at the tip of the snout, where it forms remarkable anastomoses with the superior maxillary; fifth, an opercular branch (μ), which traversing a canal of the temporal bone, gives branches to the crotaphite, to the cheek, the muscles of the operculum, to the operculum itself, penetrating lateriorly, it joins in front with the inferior maxillary nerve, and is distributed behind to the inferior opercular pieces, and to the branchiostegal membrane; and lastly, almost always sixth, a branch (ξ), which, ascending towards the top of the cranium, unites with a branch of the eighth pair, (θ) to pass out by a foramen of the parietal and interparietal, and running along the back in (\ominus), at the sides of the dorsal fins, it receives twigs from all the intercostals, and furnishes others to the muscles and rays of the fins.

The course of this branch is superficial, until it dips under the small external muscles of the rays. It has sometimes also superficial branches which descend to the anterior parts of the muscles of the

trunk, over the pectorals, as well as others which go towards the anal, where they form a longitudinal nerve like that of the back.

This nerve is very large in the silures, and has been described in the common silure, and in the lote by M. Weber; but it is found much smaller, in many other fishes, and probably in all.*

The seventh pair of nerves (*s, s*), as in the other vertebræ belongs to the gills, and arises on the sides of the medulla oblongata, between the fifth and the eighth pair, and is divided variously, to penetrate into the sacs which contain the stones, and the ampullæ of the semi-circular canals. It also contracts unions with the last branch of the fifth pair (*u*). One of these unions with the first branch of eighth or gloss-pharyngeal (*v, v*.) is constant.

It is chiefly in the distribution of the eighth pair, that we may admire the uniformity with which each nerve adheres in all classes, to the performance of the same functions.

The glosso-pharyngeal passes out of the cranium, sometimes by a foramen of the lateral occipital, sometimes, as in the cod, by a foramen of the petrous bone, and is distributed to the first branchia, to some of the surrounding parts, and passes to the tongue, in which it is expanded.

The vagus, properly so called, comes out of the cranium through a foramen of the lateral occipital larger than the preceeding, and sometimes dilates close to its origin, as in the carp; at others, as in the perch, this dilatation into a ganglion occurs at a greater distance; the ganglion (*t*) furnishes branches to the three last branchiæ, and to the inferior pharyngeans. The trunk of the nerve is continued on the pharynx, and follows the œsophagus to the stomach.

It will be observed that this distribution is the same, as that which obtains in the other vertebratæ, with respect to the functions which the nerve performs, the only difference is, that it has modified its course by going to the respiratory organ, because this organ itself has changed its place.

But this pair furnishes another nerve, and sometimes two: whose relation to those of the superior classes are not quite so apparent. The first is a branch which comes out sometimes from the anterior base of this pair, sometimes from the posterior border of its ganglion, passing in a straight line to the extremity of the tail. In a great number of fishes, particularly in the perch, after giving a superficial twig (*π*) which follows the commencement of the lateral line, this nerve proceeds in a straight line (*ε*) in the substance of the lateral muscles, between the ribs and their appendices, receiving from all the nerves of the spine, different particular twigs from the intercostals, and furnishing twigs to the skin through all the intervals of the muscular layers.

In others, as in the cod, it is superficial throughout its entire length, and seems to have no communication with the spinal nerves, or if it has, at least, it is not easily traced.

* We can have seen in the lote, the morue, the perch, the bar, the carp, the common silure, the bagre, &c. That of the carp comes from the eighth pair, and not from the fifth; that of the silure on the contrary comes only from the fifth; but in the morue and perch, &c., it comes from both pairs.

In the carp, these communications take place by exceedingly fine threads.*

The second of these nerves (θ) is that which unites with a branch of the fifth pair, to form the dorsal nerve, (Θ) of which we have already spoken.

The branch (ϕ) which gives twigs to the diaphragm, comes also from the nerve of the eighth pair.

The last of the nerves of the cranium, comes from the medulla oblongata, after the eighth pair; it gives a branch to the natatory bladder, after which its main trunk is distributed to the anterior part of the shoulder, going as far as the muscles, which extend from the humerus to the os hyoides; but branches are sent off from it to anastomose with the first spinal, and this plexus forms the trunk from which the nerves of the external muscles of the pectoral fin, and those of its anterior surface proceed.

The second spinal pair (ω) gives nerves to the interior muscles, and posterior surface of this same fin.

In the tringles, this pair is remarkable from the size it assumes in coming out of the vertebral canal, and from the large branches which it gives to the free rays, placed in these under the pectoral fin. It arises in this fish at the side of the last of the five pairs of tubercles which follow the cerebellum in the singular organization of this genus.

In fishes whose pelvis is suspended from the bones of the shoulder, whether their ventrals come out in front of the pectorals or under them, or behind, the ventrals derive their nerves from the third and fourth spinal pairs; the third supplies their muscles attached to the pelvis; the fourth supplies them also, but it is for the most part distributed to their rays: these muscles also receive some twigs from the fifth.

In the fishes called jugular, whose ventrals are attached farther forwards than the pectorals, these nerves are curved below to reach the parts under the throat for which they are destined; but they arise from the same pairs.

This is not the case with the fishes called abdominal. The nerves which supply their ventrals come from more distant pairs. In the carp, they are furnished from the seventh and eighth spinal pairs.

* M. Weber has thought, that it was a character proper to the dorsal nerve to receive twigs from the spinal nerves; but the lateral nerve from the eighth pair, receives twigs from them also in a great many fishes, and probably this will be found to be the case in all.

Plate IV (in Θ) exhibits a part of the dorsal nerve formed by the fifth and eighth pair, before it dips down under the small lateral muscles of the rays, and (in $\xi\xi$) the superficial nerve from the eighth pair, which runs under the lateral line. We have represented in pl. V, the dorsal nerve (in Θ) throughout its entire extent, with the filaments it receives from all the nerves of the spine; and the deep seated lateral nerve ($\pi\pi\pi$) of the eighth pair, which passing under the appendices of the ribs, also receives filaments from all the spinal nerves, and goes to its termination in a plexus on the side of the end of the tail. The branch of the first, which, in the cod for instance, follows the base of the anal, could not be shown because we could not find it in the perch.

The chondropterygians differ little from other fishes, with respect to the distribution of the nerves of the cranium; but their nerves of the pectoral arise from a much greater number of origins. At all events we shall treat of their neurology in a more special manner when we come to their history.

CHAPTER VI.

*Organs of the external Senses in Fishes.**

The senses of smell, sight, and hearing are conferred on fishes by organs, analogous to those of other classes, and arranged in the same manner; if their taste be feeble, there is nevertheless reason to believe, that it also resides in the covering of the tongue, unless the singular tissues which are found in the palate of some species, such as the cyprins, should also be regarded as the seat of it. As to the touch, besides their general integuments the sensibility of which varies to infinity, particular dispositions of certain parts, which become more or less prolonged, and more or less moveable according to the species, furnished them with organs, which are often as singular, as they are remarkable.

The Eye.†

The eye in fishes is suspended in an orbit, of which the composition has been already described, in the chapter on osteology; vaulted

* The organs of sight, hearing, and smell taken from the perch, are represented pl. vii. viz: the nostrils fig. 11; the eye from fig. iii. to viii.; the ear fig. 9 and 10.

† The folded membrane which forms the optic nerve has been described and drawn by Malpighi in the xiphias.

The memoirs of *Petit* the physician, inserted in those of the Academy of Sciences for the years 1726 and 1730, contain several good observations on the eye of fishes. In the memoirs of the latter year, he enters into details, respecting the forms and curvatures of its parts, and particularly of the crystalline lens of several salt and fresh water fishes. Haller studied and described all the parts with accuracy, but only in fresh water fishes, in the memoirs of 1762. His work presented with additions to the Society of Gottingen in 1766 was reprinted in latin in his *opera minora*, vol. iii. In this work, he describes the falciform ligament of the crystalline lens, the two lamina of the retina, &c.: he takes the red body which lies between the ruychian and the sclerotic for a muscle.

Vicq d'Azyr, in his memoirs on fishes, does not speak of the eye; and Monro confines himself to a few details on its humours, considered in a dioptrical point of view.

I have added some facts in my lectures on comparative anatomy, vol. iii. in which I have shown particularly the differences in the eyes of the chondropterygians; other facts will be found in a memoir of M. Rosenthal, printed in 1811, in the tenth volume of the Archives Physiologiques de Reil.

M. de Sæmmering's son gives, in his dissertation on the transverse section of the eye, (Gottingen 1818, in folio,) five drawings of sections of the eye of the sturgeon, the aiguillat, the ray, the cod, and the pike.

Some useful facts will also be found in M. Angely's thesis on the eye and

above by the principal frontal, bounded in front and behind by the anterior and posterior frontals, the frame of this orbit is completed beneath by the chain of suborbital bones; the anterior sphenoid, with the membranes attached to it occupy the bottom; lastly, its floor is in part supported by the pterygoidean, and by a more or less considerable portion of the other bones of the pterygo-palatine apparatus.

The position, direction, and size of the eye in fishes, vary to infinity.

In some, they look towards the heavens, and are frequently very close to each other; in others, far asunder, placed at the sides, and even directed somewhat downwards. But in all this variety of direction, we observe the most extraordinary one in the genus of pleuronectes (turbots, plaice, soles, &c.,) in which the two eyes are placed one above the other, or at the same side of the head. In certain fishes of the genera, eels, and silures, the eyes are so small as to be scarcely perceivable; whilst in others, such as the priacanthus, or the pomatomus, they exceed by the proportional diameter any thing with which we are acquainted in the superior classes. It may, however, be stated, that the eye is larger in fishes in general, and particularly that the pupil is large and open, a disposition which is well adapted for collecting the rays of light at the bottom of the water, where they penetrate in such small quantity.

It has no true eye-lashes: the skin passes over the eye, and forms there a conjuncture slightly adherent which is often sufficiently transparent to permit the rays of light to pass to that organ. In certain fishes, for example the eel, it passes without causing the least fold: there are some, as the cecilia and gastrobranchiæ, in which it remains opaque, and hides all traces of the eye. In others, such as the mackarel, and the herring, it forms an adipose fold before and behind; but these folds are fixed, and without muscles or motion: in the squalus they are slightly moveable at the inferior border of the orbit. Sometimes, as in the moon-fish, the skin is puffed out around the eye, and is furnished internally with fibres that constitute a kind of sphincter, whose action is counterbalanced by several layers of fibres in the direction of the rays.

The globe of the eye* is slightly moveable. Like that of the human

lachrymal organs (Erlang 1803); in Muck's thesis on the ophthalmic ganglion (Landshut 1815); and in M. Massalien's, on the eyes of the tunny, and of the cuttle-fish (Berlin 1815). Lastly, M. Jurine has published in 1821, in the first volume of the Physical Society of Geneva, observations on the eye of the tunny, in which he throws out important remarks on the eyes of other fishes.

* Fig. ii. pl. vii. represents the globe of the eye, entire, seen from behind, the muscles being separated, and exhibiting the hole for the nerves; the oily body would appear, through the selerotic. In fig. iv. the selerotic is opened, and the lobes separated; the optic nerve is denuded of its covering, and unfolded; the greasy body may be seen naked beneath the selerotic. In fig. v. this greasy body is enveloped, as well as the silvered layer which envelopes the choroid, and the red body may be seen naked, and in the form of an horse shoe, placed between this layer and the choroid. Fig. vi. is the globe deprived of its selerotic and cornea, and viewed laterally, showing the protrusion of the cristallin outside the pupil. Fig. vii. is a section of the globe of the eye in the vertical direction, and showing the mutual encase-

subject, it has six muscles, of which the four right ones (Nos. 1, 2, 3, 4, fig. iii), arise from the bottom of the orbit near the circumference of the optic foramen, and two oblique, (*a b*,) arising from the anterior wall of the orbit, and are inserted transversely, the one above, the other below, into the globe. The superior oblique is destitute of the pulley which changes the direction it has in quadrupeds. The muscle which forms the siphon in quadrupeds is likewise wanted.

The fourth pair of nerves are inserted into the superior oblique, and the sixth pair into the abductor; the others receive their nerves from the third pair precisely as in the vertebrated animals.

The intervals between the orbit, the globe, the muscles, nerves, and vessels are furnished with a loose cellular tissue, filled with a gelatinous fluid, adapted to afford facility to the movements of the eye.

There are neither lacrymal gland, nor puncta lacrymalia in their eyes, and in effect this apparatus is not necessary to animals whose eyes are constantly moistened by the water in which they live.

In the rays and squalus the globe of the eye is borne upon a moveable cartilaginous pedicle, attached to the bottom of the orbit between the origin of the two rectus muscles; an arrangement which gives strength to its movements.

The anterior surface of the eye (*e*, fig. VII) is generally level or slightly convex, and the aqueous fluid is but little abundant; the remaining part of the surface of the globe is spheroidal, at least more or less approaching to the figure of a sphere, but sometimes is rather irregular. The rays have the upper portion flat so that the eye, in this species, presents the general form of a quadrant of a sphere.

The eye of the anableps is very remarkable, it has two corneæ which are separated by an opaque line, and two pupils perforated in the same iris, so that they appear double; but it has only one vitreous humour, one crystalline, and one retina.*

The crystalline lens of fishes (*d*. fig. VI, VII, VIII) is sensibly spherical, very voluminous, and has a less space for the vitreous humour than the eyes of animals which live in the air. Its consistence is very great; its nucleus, which is very hard, remains transparent even in spirits of wine, its external layers are numerous, and are divided into fibres in the direction of the meridians of this small globe: its capsule is soft; it is attached in a hollow of the vitreous by a circular line, produced by the membrane of the vitreous, which surrounds it very nearly like the horizon of a geographic globe. (*a*)

ment of all the parts. In fine, fig. viii. is the globe cut across, and showing the crystalline ligament.

1. If we take their direction with regard to the axis of the eye, or to its exterior surface, they are frequently very oblique: this probably is what made Albers say that the dorad (*coryphæna*) has two right muscles, and four oblique; but I have followed the nomenclature used in the human subject.

* See Lacépède, Mem. de l'Institute, sc. math. et phys., t. 11, 1799, p. 372.

✎ (*a*) Dr. Brewster by some investigations lately undertaken, has shown that the crystalline lenses in all animals are composed of fibres, and that if the laminae

There is, moreover, in a great number of fishes a falciform ligament (*e*, fig. VIII) which passes by a furrow of the retina and penetrates into the vitreous, of which it is the only bond. This ligament arises at the entrance of the optic nerve, and follows the interior concavity, descending towards the base of the eye; it contains the vessels and nerves: its inferior point, nearest the uvea, is attached to the capsule of the crystalline by its inferior surface, sometimes by means of a simple prominence or a lamina a little more opaque; sometimes, as is observed in the tunnies, by means of a species of granular body or transparent tubercle, and harder than the vitreous into which it is inserted.* There are fishes, such as the salmon, and herrings, in which this ligament is opaque and black, like the internal surface of the ruyshian ligament.

In the chondropterygians this ligament does not exist, neither does it exist in many of the malacopterygians, especially the carps.

In the conger are perceived two very small ligaments, one placed anteriorly and the other posteriorly, which support the crystalline as by means of two poles.

There are four and even five tunics in the eyes of fishes. The most external (*f*, *f*), or the sclerotic, is thick, fibrous, supported in part, in most species, by two cartilaginous pieces, inserted into its tissue, and which have a space between them posteriorly; they are more or less ossified in large fishes, and even in certain species, for example in the sword-fishes, they form for themselves a spherical envelope completely ossified, with the exception of the orifices for the entry of the nerve and the encasement of the cornea.

In the chondropterygians the sclerotic is destitute of these pieces; it is uniformly cartilaginous; in the rays and squalus, its cartilage has posteriorly a prominence for articulation with the pedicle which supports the globe. In common fishes its fibrous part frequently assumes a thickness posteriorly, and forms a tuberosity.

The anterior opening of the sclerotic forms a frame for the cornea, which is there inserted into a circle frequently a little thicker. The cornea is lamellated as in the other classes, and its internal lamina is sometimes coloured with yellow or green, as is seen in the perch.

Under the sclerotic is first, in many fishes, a cellular tissue of a greasy nature (*g* *g*, fig. iv.), of a greater or less extent, and which sometimes forms a thick layer. It is wanted in the cod and in other species, but it is very thick in the scœnas: in the perch it forms different lobes in the circumference of the globe.

be removed the surfaces appear fibrous or grooved. The fibres are arranged in five different modes, the same mode being found invariably in the same animal. In the greater proportion of lenses of all animals the structure is symmetrical, in relation to the anterior or posterior surfaces, or to the poles of the axis of vision. However there are some fishes which present a remarkable deviation from this law, by having the anterior surfaces having their fibres arranged according to one mode, whilst those of the posterior assume some other plan. The Doctor supposes that this is intended as a means of correcting the aberration.—ENG. ED.

* This is what Mr. Jurine names the cristalline ganglion. Only having seen it in two eyes changed by the spirit of wine, he supposed it to be opaque.

More internally is a very thin membrane, almost without consistence, which at first sight resembles only a silver or gold colour, and which encloses all the more internal parts. It is this same layer which is continued outside the iris, and which gives it that beautiful metallic lustre which is generally so brilliant in the fishes.

The pupil of fishes has not generally the faculty of changing its diameter; but we must remark the singular truncated prolongation in form of a palm which its superior border forms in the rays and pleuronectes, and which close the opening of the pupil, in the same way as a window-blind.

The posterior surface of the iris or the uvea, is formed by another membrane, which lines the whole interior of the eye, and of which the internal surface is generally furnished with a coat or sort of varnish more or less black. This membrane, which is very finely vascular, may be divided into two lamina: the internal one, very thin and simple, is a true ruyschian; the external one, which is, properly speaking, the vascular lamina, is rather thick; this is the choroid.

In large eyes the ruyschian sensibly forms, at the internal surface of the uvea, at the part where are situated the ciliary processes of mammifera, a circle of radiated and very fine folds; but these folds do not project, neither do they extend so far as the capsule of the cristalline, so that they cannot be called true ciliary processes. These folds, as well as the rest of the urea, immediately touch the vitreous body, and strongly adhere to it; and the anterior convexity of the cristalline frequently projects through the pupil in such a manner, that the aqueous humour has no posterior chamber.

Between the choroid and the membrane of the metallic colour which envelops it, is an apparatus proper only to fishes, and even to osseous fishes, for it is not present in the chondropterygians. It is a band or pad variously curved (*h h*, fig. v.), and forming an irregular and incomplete ring, which surrounds for some distance the entrance of the optic nerve. This pad is sometimes divided into two parts; at others it presents a large crossing, but it has always a solution of continuity with its inferior part. It is always very red; its tissue presents blood vessels which are either transverse, densely compact, or parallel with one another. It gives out other vessels, frequently very tortuous always very much ramified, and which form, in the thickness of the choroid, a compact net-work, which Haller considered as a particular membrane.

The nature of this pad is not easy to determine. Some have thought it muscular; but the red striæ, which are seen in it, are vascular, and not fibrous; others have regarded it as glandular; but it appears to me to arise only from blood vessels. Perhaps it is an erectile tissue, analogous to that of the carnivorous bodies, and which has some influence in accommodating the form of the eye to the distances and density of the media.

The optic nerve (*i i*, fig. iii. to vii.), as we have said above, is composed, in many fishes (at least amongst the acanthopterygians), of a plaited membrane, enveloped in a tunic more or less strong, which terminates at the sclerotic: it extends in a point of the eye sufficiently

remote from the centre, and most frequently penetrates it obliquely. After having penetrated the sclerotic, it frequently makes a long furrow through the greasy tissue and between the branches of the vascular tissue, before penetrating the choroid and the ruyschian. Its diameter shrinks considerably when it enters the ruyschian; sometimes it appears at the interior of the eye as a white, and round or irregular spot, and sometimes as a line. When the nerve is folded, the retina itself has its internal lamina very much folded; it lines, moreover, as is common, all the interior concavity of the eye as far as the origin of the uvea, and envelops also almost all the vitreous. In those fishes which have a falciform ligament, it is cleft to allow it to pass, but it very closely contracts, and its fissure is frequently marked by two whitish lines which follow on this side the whole of the concavity of the eye. The retina is easily divided into two laminae, the internal of which is thinner and more fibrous, and the external more pulpy.

From this general structure of the eye of fishes, the nearly complete spheroidal character of its crystalline, the immobility of its pupil, the difficulty there is in it of varying the length of its axis, we can have no doubt that their faculty of seeing is very imperfect. Images can be only confusedly painted upon their retina; and consequently it is not probable that they are susceptible of distinct perceptions of the forms of objects. It is nevertheless certain that they discover their prey even at a great distance, and that they know it by seeing it, since artificial flies deceive them, and cause them to bite the hook as if they were real baits.

The Ear.*

The ear of fishes consists in some measure only of the labyrinth, and moreover a labyrinth less complicated in many respects than that of quadrupeds and birds.

* As far back as 1600, and 1610, Casserius had examined many important parts of the ear of fishes, and was better acquainted with it, than with the same organ in man; for his *Pentesteseion*, page 224, contains a tolerable drawing of the semi-circular canals, and petrous bones of the pike.

In the *Acta Medica* of Copenhagen, for the year 1673, Stenow gives an abridged description of the internal ear of the mustelus, which, though unaccompanied by a drawing, is tolerably exact.

It may also be inferred from certain expressions of Swammerdam, (*Bibb. Nat.*, vol. 1. p. iii.) that the labyrinth of fishes was not unknown to him. But his book was not printed till after his death in 1737.

It is also said that Duvernay was aware of it; but his observations on this subject have never been published.

Bromel, Professor Upsal, has given a catalogue of the stones of the ear of fishes which he had collected.

Klein, in his first *Missus historiae piscium promovendæ*, printed in 1740, speaks in detail of those stones, and gives correct drawings of them, though not in situation or in connexion with the labyrinth, in the pike, salmon, trout, ombre, marenæ, herring, cod, dorsch, lote, sandre, perch, the acerina, the gasterosteus, the turbot, plaice, harbel, and several other cyprins, &c., but entirely independent of their position and their connexion with the labyrinth.

In 1753 Etienne Louis Geoffroy, a Physician of Paris, presented to the Academy a memoir ex professo, on the ear of fishes, which was not printed till 1778. It con-

They have no external ear, at least, unless this name can be given to a little cavity, sometimes slightly turned into a spiral form which is anterior to the species of fenestra ovalis in the ray; a cavity entirely hidden under the skin. Bony fishes have neither this cavity, nor even any fenestra ovalis: some amongst them, as the lepidoleprus and certain mormyri, have only at the cranium openings stopped by the skin, by which the vibrations of the ambient liquid may be immediately conducted to the labyrinth. In others, such as the myripristes, the cranium is opened below, and its orifice is closed by a membranous septum to which the air bladder adheres; but these communications are very different from that which takes place through the medium of the tympanum, and still more that which takes place in the eustachian tube.

The fishes are in fact deficient of the tympanum and its small bones, as also of the eustachian tube. Those who are anxious to discover, in the bones of the operculum, the four small bones of the human ear suddenly and prodigiously developed, could never have entertained such an idea, except in conformity with the very dangerous system which represents that the osseous pieces ought to be found in the same number in every head, and indeed they can offer no other reason in its favour: neither the form, relations, nor functions of these bones, nor the muscles which are attached to it, nor the nerves which go it can be forced into the comparison; but this identity in the number of pieces admits of so many exceptions that it cannot serve consistently

tains a good description of the ear, in the eel, whiting, pike, carp, cyprin, plaice, and perch; he mistook, however, for a meatus externus, certain foramina of the cranium, which do not appear to have that destination. The figures originally annexed to the memoir having been lost, there are none given in the publication. What he says of the ray, is comprised in a memoir on the ear of reptiles presented in 1752, and published in 1755.

Pierre Camper's investigations were made in 1761; they first appeared in the Harlem memoirs in 1762. He addressed them in an amplified form to the Academy of Sciences in 1767; these were published in vol. vii. of the learned foreigners, in 1774. In these he describes especially the ear of the ray, cod, pike, baudroie, with figures in his own, vague style. He added little to what Geoffroy had said before him, except that he denied in too general a manner, the existence of the exterior canal, and that he spoke of an organ which he called the tensor bursæ, and which appears to be no more than an appendice, or rather a ligament stronger in the pike than in many other fishes.

In 1773, Kælleuter has given, in the seventeenth volume of the *Novi Commentarii* of Petersburg, a description with figures of great accuracy and detail of the ear, of two sorts of sturgeon, the common one, and the huzo.

M. Monro states that he had not paid any attention to the ear of fishes till he had heard of the observations of Camper; but his information had reached him but tardilly, for he had not heard of them till 1779. His own observations appeared in his *Anatomy of fishes* 1785, accompanied by beautiful plates. He has described better than either his predecessors, or successors, the external ear of the chondropterygians; it is remarkably well seen in his collection of three treatises on the brain, eye, and ear, published in Edinburgh in 1792.

John Hunter asserts that he had discovered the internal ear of fishes as far back as 1786; but he did not publish his remarks, and then only as an extract, till 1786, in his observations on certain parts of the animal economy. He acknowledges that Geoffroy had preceded him on the ray.

But the most exact description and finest drawings of the ear of fishes are due to M. Scarpa, in his *Disquisitiones de auditu et olfactu*, printed at Pavia in 1789. He

with strict logic to prove another proposition, being itself in a state of doubt.

With respect to those who have thought that they beheld in the vast and quintuple communication of the branchiæ with the mouth, a development of the eustachian tube, they have not even sought to support their system or any sort of resemblance in the number and structure of the parts.

There would have been something plausible to alledge in favour of M. Weber's idea; for it went to show the analogues of the bones of the ear in the osseous species which are placed at the side of the first vertebræ, and which support the air bladder in the cyprins and silures. Indisputably these osseous pieces as we have seen elsewhere, have a direct communication with the labyrinth; but this connection is not at all like that of the little bones of the ear in the higher animals; and though it were demonstrated that they participate in the functions of the organ of hearing, still they do not the less remain, as M. Geoffrey has proved, simple dismemberments of the transverse apophyses of the first vertebræ.

Analogy does not render it otherwise likely that we should have bones necessarily in the fishes, since we see these bones degenerating in number and volume, from the quadrupeds even down to the salamanders, and the sirena, where they are reduced to a single small plate which represents the last half of the stapes.

there gives a drawing from nature of the ear in the ray, baudroie, and pike. He erroneously denies the external communication, discovered by Munro, in the ray.

In the same year 1789, M. Comparetti published at Padua, his observations on the internal ear, in which he carefully describes, and represents accurately, though not elegantly those of the ray, of the angel fish, sphinax, mustelus, the sturgeon, of the tunny, the eel, the plaice, the pike, the denzelle, the carp, and gudgeon.

It is from the researches of these authors, and those which I myself have made that I have described the ear of fishes in my Comparative Anatomy. I have added some facts relative to the sturgeon, the moon-fish, to the distribution of the nerves, &c., and I should not suppose that this description, in as much as it is a general one would require to undergo any modification.

But in a latin work, printed at Leipsic in 1820, on the ear of man and animals, M. Ern. Henri Weber has given interesting details on this department of fishes, with very clear descriptions, and with very fine and very faithful figures; he has there offered an entirely new hypothesis respecting the small bones which adhere to the first vertebræ of the spine in the cyprins, silures, and cobites, which have been regarded to the present time as exclusively appropriated to the swimming bladder, but which M. Weber has shown to bear some relation to the ear of fishes. This leads him to believe that they represent the small bones of the tympanum in man and the higher animals, and not only these bones but the swimming bladder itself are amongst the organs which are subsidiary to the ear. This opinion has been supported by M. Bojaneus, in the *Isis* of 1818.

M. Geoffroy has contended against it, at least in one sense, for he has made it manifest that these small bones are more dismemberments of the first vertebræ than true bones of the ear, which he still continues to believe to be represented by the opercular pieces. Since then I have discovered relations between the ear and the natatory bladder of fishes, the existence of which had not been before suspected, and in the myripristis.

Lastly, there are some curious observations of M. M. Otto and Heusinger on the apertures of the cranium in the lepidoleprus and the mormyr, through which something of the vibrations of the ambient element may be transmitted to the internal ear.

The membranous labyrinth in the rays is entirely enclosed in a larger osseous labyrinth, hollowed on the sides behind the cranium, in the inner part of which it is supported by vessels and cellular membrane, and it adheres by a sort of ligament to a portion of the superior surface of the cranium which is pierced by a small foramen, and closed by a membrane. On this membrane is a small membranaceous excavation covered by the skin; this is the whole of the communication of the labyrinth with the outside, and it has no communication with the inside of the cranium except by foramina,^r which serves for the transmission of the nerves.

The sturgeon and the moon-fish have only their semicircular canals enveloped in the canals which are traced in the cartilage of the cranium, but the remainder of their labyrinth is in the cranium itself. In these fishes there is also something which approximates them to the pikes.

In a very great number of the osseous fishes, the whole of the membranous labyrinth is suspended in the cavity of the cranium which is merely a lateral depression of the large cavity in which the brain is placed. Of the vestiges of the osseous labyrinth some osseous or membranous traces remain, and around them turn the semicircular canals; there is also near them a cavity more or less deep, formed in the base of the cranium above the basilar bone, where the sac is merged, of which we shall presently speak.

We should, however, remark a principal ligament which suspends the two vertical semicircular canals to the arch of the cranium, near the posterior border of the parietal, and which has a close resemblance to that which communicates with the *fenestra ovalis* in the ray.

The oily or mucilaginous liquor which usually envelopes the brain, penetrates also into the cavities, and surrounds the membranous labyrinth.

The semi-circular membranous canals, three in number each swelled to an ampulla, which receives the filaments of the acoustic nerve, differs from those of the superior classes only in their greater extent. One of them is situated inferiorly, it is nearly horizontal, having a direction towards the side of the brain, and two almost vertical, one anterior, the other posterior. These two are united by one of their extremities, so that all three together terminate by five orifices only in the common cavity which represents the membranous vestibule.

The form of this cavity varies greatly; sometimes it represents a long canal, sometimes an oval sac, or triangular pyramid, &c. That which is called the sac is an appendix of the vestibule, from which it is distinguished by a constriction. This constriction is said to be so impervious, that injections will not pass from one cavity to the other; but this is not the case, at least, in the chondropterygians. The membrane which forms the vestibule and the sac, appears uniform, and is much thinner and finer than that of the semi-circular canals. The sac is in general under, and most frequently behind the vestibule; it is lodged in a concavity of the floor of the cranium, and sometimes, this concavity is so closed by an osseous lamina, as only

to leave an orifice for the constricted part which connects the sac with the vestibule.

The liquor which fills the entire labyrinth, is slightly gelatinous and perfectly transparent; the sac and vestibule are swelled with this fluid; they contain besides bodies of a peculiar nature, of the consistence of starch in the chondropterygians, and of a purely stony nature in the other osseous fishes.

In the latter there is generally one of these bodies in the vestibule, and two in the sac, a large and a small one, the latter are separated from each other by a membranous septum.

These stony concretions, and masses of amylaceous consistence, are entirely calcareous, and are dissolved by acids with a brisk effervescence. Nothing can be discovered in them resembling the organization of bones; they are more like shells.

Their form is very determinate, and often very singular, and perfectly invariable in each species, indeed so much so, that bony fishes may be distinguished by their ear stones, almost as easily as by any other character: for instance, in the cod, they are elliptical, notched on the edges, and raised in the middle; in the scienas they are oval, very thick, tubercular in some places, and marked by a curved furrow, running along its surface, &c. (*a*.)

The acoustic nerve is given off from the brain, nearly opposite the junction of the sac with the vestibule; superiorly it gives a twig to each of the semi-circular canals; this twig enters the ampulla of the canal to which it belongs and is there expanded. Another portion of the nerve goes to the vestibule; but the most considerable part of it expands into an infinity of filaments, which form a beautiful apparatus under the wall of the sac containing the large stone.

The disposition of the semi-circular canals in the rays and squalus differs, in some respects, from that which is found in osseous fishes; in the former, they terminate at the vestibule in the form of a tube, the superior extremity of which adheres to the fenestra ovalis: this vestibule, after receiving the semi-circular canals, terminates in a large oval sac, which has itself two appendices, an anterior and posterior. It can scarcely be doubted, that this appendix represents the small cavity, the only vestige of a cochlea which remains in reptiles, and the rather as in reptiles it likewise contains a small mass resembling starch.

This conclusion ought probably to be extended to the sac in osseous fishes, notwithstanding its backward position, the more so, as it is frequently, and perhaps always, divided into two cavities by a membranous septum.

The ears as we have now described them, it will be observed, are much less perfect than the ears of quadrupeds, birds, or even those of most reptiles. Destitute of the tympanum, the small bones and the eustachian tube, they can scarcely receive the impression of the vibrations of the ambient element, unless they are communicated to the cranium, and besides, as the bones do not press closely on the mem-

* Klein's treatise on these stones may be consulted; it might have been considerably augmented.

branous labyrinth, the cranium cannot transmit its oscillations to the labyrinth, but in a feeble degree. The absence of a true cochlea and its fibrous lamina, will not allow us to believe that the ear of fishes can be affected by the difference of tones. It simply offers to the physiologist, a very sensitive membranous apparatus, in which the nervous filaments distributed in the ampullæ of the semi-circular canals, must participate in all the movements of the fluid in which it is plunged, and in which, those that are attached to the sacs and vestibule must be still more vividly agitated, by the shocks communicated by these movements to the stones contained in these cavities.

It is therefore probable that fishes hear; that noise produces in them a strong sensation, but that they cannot distinguish either the infinite variety of tones, or those articulate sounds, with which quadrupeds, and birds appear to be so vividly struck. All that we learn from experience, as to the degree in which fishes enjoy the faculty of hearing, is shewn in their being easily frightened by sudden and unusual noises; in the necessity which fishermen feel of observing profound silence, in order not to put them to flight; and in their habituating themselves to be called to receive food, and know the sounds employed for that purpose.

We have seen elsewhere, that the Romans had trained them to know their own names; but we are not aware, that the moderns have carried their education to the same extent.

As to the special apparatuses, which are only found in certain genera, such as the silures, cyprins, cobites, and lepidolepruses, which have been looked upon as substitutes or analogies, for the tympanum, and small bones of the ear in mammalia, since these are only exceptional organs, which are far from belonging to the entire class, we shall refer their description to the chapter on the genera which are provided with such organs.

Nostrils.

The nostrils of fishes are not so disposed, as to be passed over by the air or water during respiration. They consist of two fossæ hollowed out towards the front of the snout, and lined with a pituitary membrane, which forms very regular folds. In ordinary fishes, the bone, which we regard as the nasal, covers them like a vault, and the vomer, the maxillary, and intermaxillary contribute to support their walls; the first suborbitaly forms their inferior border. Their form is sometimes oblong, and sometimes oval or round. They are placed either at the end of the snout or on the sides, sometimes on its superior surface, and in the ray, and squalus, even on its inferior surface, near the corners of the mouth. In the lamprey they are situated close together on the top of the head, and open by a small common aperture. In the majority of fishes, perhaps in all the osseous, they open each by two orifices, one before and one behind, and sometimes at some distance from each other; this is called the double nostrils, a denomination which is evidently improper, as they communicate only with one cavity.

The edges of the anterior orifice are often tubular as in the eel;

and sometimes the tubular character of the edge is continued as in the lotus, and in several of the silures, on one of its sides, into a tentaculum (feeler) of greater or less size. At other times these edges do not exist, as we see in the *sombres*, in which, moreover, the posterior orifice is a vertical line.

The nostrils of *lophius*, by a remarkable singularity, are supported like mushrooms, each on a small stalk; the head of this sort of mushroom contains the cavity of the nostril, which opens in the usual way, by two small orifices,

In some, the posterior opening is under the lip; this is the case in some foreign congers, a coincidence sufficiently remarkable with what occurs in the *sirens* and *proteus*.

In the species in which the fossa is round the folds of the pituitary membrane which line it, are disposed like radii of a circle round a centre or short line*; but in those in which the fossa is oblong or elongated, they are ranged on each side of an axis, forming very regular combs, or rather representing the feathers of a quill. Their number and the amount of their prominency vary much; they can scarcely be seen in the lump-fish: in the perch, for example, they are only sixteen in each nostril; in the turbot twenty-four; in the conger or eel, they are almost innumerable, on each side of a salient axis, which runs along the entire length of the internal surface of the tube of the nostril. The rays themselves are subdivided into small branches in the sturgeon, and perhaps even in other species; in a word, the surface of this membrane is multiplied in various ways.

This surface is furnished with numerous fine vessels, secreting an abundant mucus with which their intervals are filled.

The olfactory nerve, coming out from the anterior tubercles of the brain, sometimes single, sometimes double, sometimes divided into filaments, varying in length and size, according to the species, goes to the posterior or convex surface of the nostril. It varies a good deal as to its course, and as to the manner in which it arrives at its destination.

In certain fishes, such as the *tetrodon*, it is very slender; in others, as the cod, it is slender, but double or triple. In the ray and *squalus*, it is thick and single, and sometimes so much, so as to seem but an appendix of the brain; in the tunny it is simple, also, throughout its entire length. In the perch, it is divided into two in its middle, and its filaments are multiplied in the neighbourhood of the nostril. In the turbot and in *lophius*, it is divided from its origin near the brain, into several filaments. In the conger and eel, it is divided almost from its origin into two large trunks, which give each successively a great number of branches, subdivided into smaller ramifications for all the lamellæ of their long nostril.

In several genera, the olfactory nerve, as we have said, when it arrives at the nasal fossa, swells to the size of a ganglion; this we see in the cod, carp, and in the cyprins generally.

* The olfactory nerves, and the nostrils of the perch detached from the bones, are shown pl. VII. fig. 2. One of the nostrils is entire and opened, to show the rays: the other is cut in the middle to shew the distribution of the nerve to the membrane.

It has been observed that this inflation occurs usually in those fishes in which the nerve is not swelled at its base ; and in which, consequently, there is no supernumerary pair of tubercles in front of the anterior lobes of the brain.

Nevertheless, it is swelled very evidently in the rays, although these tubercles are wanting.

The filaments of the olfactory nerve penetrate regularly into all the folds of the pituitary membrane, and terminate at their edges.

We do not perceive, in osseous fishes at least, that the covering of the nostrils enjoys any mobility, or that the orifices are furnished with muscles to open or shut them.

It is certain that fishes enjoy the faculty of smelling ; that odours attract or repel them ; and there is no reason to doubt that the seat of this faculty is the organ now described.

However, it is by no means impossible, that this delicate membrane may also be used in recognizing substances mixed with or dissolved in water, and which of themselves would possess no odour, thus directing the fish in the selection of the waters which would be more or less suited for it.

It may be safely conjectured, that the degree of the faculties with which this membrane is endowed, depends on the development given to it by the number and extent of its folds.

Organs of Taste.

Fishes, with few exceptions, swallow their food rapidly, and without chewing ; even those whose jaws are armed in such a manner, as to bruise and cut their aliments, cannot keep them long in the mouth, on account of the position and action of their respiratory organs ; there being no salivary glands to moisten them, they could taste them but feebly, even supposing they had received organs enabling them to discern keenly the differences of the flavour ; but it appears that the organs of taste themselves are rather feeble.

There are some fishes, in which the floor of the mouth, has no prominence meriting the name of a tongue : in most, the tongue is short, and but slightly detached ; it is never supplied with particular muscles for giving a motion of prolongation, or flexion, which it has in quadrupeds ; but even when it is most distinct, and most fleshy in appearance, it merely consists of a cellular or ligamentous substance, applied to the front of the lingual bones ; lastly, its surface is often armed with teeth, sometimes densely packed together, like paving stones, and which must necessarily deprive it of whatever little sensibility it might have had, without them.

Its nervous supply is very scanty, and comes from the glosso-pharyngeal, after it has expended almost its entire substance on the first branchia.

It might be supposed that some portions of the palate, or pharynx, supply the place of the tongue for this kind of sensation, and especially as we find in the genus of cyprins, at the entrance of the throat, the vault of the palate furnished with a fleshy, soft, thick substance,

which receives many nerves from the eighth pair, and which, as it seems nearly to correspond to the pharyngean teeth, so powerful in animals, appears to have all the dispositions calculated to make them relish the food; but it would be very difficult indeed to determine the reality of this conjecture.

This organ is very remarkable for a peculiar kind of irritability; if we touch or prick it, the point pricked swells up, and assumes for a few moments, the form of a cone; this irritation may be repeated on every point of the organ, and always with the same effect as long as life remains in it, and we know that life subsists a long time in the carp, even after the head has been cut off.

This phenomenon might be made the object of interesting physiological experiments.

Organs of Touch.

Fishes are not much more highly favoured in regard of touch, than they are with respect to the organ of taste; being destitute of prolonged members, and particularly of flexible fingers, calculated to grasp objects, it is only by their lips, that they can ascertain the forms of bodies: the appendices called cirri, such as many of them, as the silures, several cods and cyprins, have round the mouth; the filaments or rays detached from the pectoral fin, which have been called fingers in the mullets and polynemes; the other moveable rays, with which the head of baudroies is provided, and which are detached from the first dorsal fin, serve rather to enable them to perceive the approach of foreign bodies, than to recognize their forms and other tangible qualities; however in the limits to which they are restricted, these organs possess great sensibility, and receive nerves of considerable size.

The general covering of the body of fishes, at least in those in which that part is covered with scales, cannot have any high degree of sensibility; but in this respect the varieties are almost infinite, from the species, which like the lamprey seem to have nothing resembling scales, or those which like the eel, have them small and thin, and as it were, lost in a thick epidermis, to those in which the scales form osseous bucklers, as in the sturgeon, or constitute by their union an inflexible cuirass, as in the coffres.

The scales are productions of the same nature as the nails or horns, but most commonly of a more calcarious substance, with which the skin of fishes is furnished.

The chemical composition of scales, has a great analogy with that of the bones and teeth. M. Chevreul analyzed the scales of a lepisosteus, a chætodon, and a bar, and obtained the following results, after having evaporated the water by exposing them for six weeks, in a dry vacuum*.

* By drying, the lepisostic had lost 11,75 per cent., the chætodon 13, the bar 16.

	SCALES		
	of the Lepisosteus.	of the Perca labrax.	of the Choetodon.
Fatty matter formed chiefly of oleine	0,40	0,40	1,00
Azotic matter	41,10	55,00	51,42
Chloruret of sodium		traces	traces
Subcarbonate of soda	00,10	00,90	1,00
Sulphate of soda		00,00	0,00
Subcarbonate of lime	10,00	3,06	3,68
Phosphate of lime (of bones)	46,20	37,80	42,00
Phosphate of magnesia	2,20	0,90	0,90
Peroxide of iron	traces	traces	traces
Loss	0,00	2,84	0,00
	100,00	100,00	100,00

In a considerable number of genera, the scales are imbricated : that is to say, they partially cover each other like tiles ; their external and apparent part is merely covered by a lamina of the dermis, which very speedily dries ; their concealed part, is buried in a cavity, or purse hollowed out of the dermis or formed by one of its folds ;* this concealed part of the shell, has usually a different surface. We perceive on it, very fine striæ parallel with its edge, and rays spreading like a fan from the centre towards the edge, which is most frequently cut into lobes and indentations. The uncovered part presents more variety ; it is sometimes smooth, sometimes pointed, sometimes covered with little asperities, or ciliæ. The scale thus enchased in the dermis, does not adhere to it by vessels,† but it would appear that it grew like the shell in the mantle of a mollusca, or as a tooth in its germ and its matrix, and the varieties of the surface of the scales, their furrows, their dimples, their crests, the spines of which are armed or bristled, the lashes or small notches of their edge, and which give, when viewed through the microscope a very agreeable sight,‡ do not surpass what is seen in shells, and in these nobody doubts that the growth is by layers.

* It might be thought at first sight, that this disposition was very different from that which obtains in a great number of lizards and serpents, in which what is called scales, is merely a production of the dermis, covered by the epidermis, which assumes at its external surface more thickness and consistence ; but the *saurians* conduct us to the tiled scales of fishes : the folds of their skin are occupied by a calcarious secretion, which forms a true scale plainly separable from the substance of the derm which envelopes it. Let us suppose this substance of the derm thinner and finer, and we shall have the scales of fishes, which seemed to be enshrined in a fossa of this dermis.

† Leuwenhoek was the first to assert that the scales grew by layers which were successively larger, and which were formed under the preceeding ones. (See his works, page 205 ; his physiological epistles 214.) But he erroneously believed that the years of the age of the fish could be distinguished by the layers in the scales.

‡ The figures may be seen in Baster (opera subseciva I, III, pl. 15) and in some plates of Amusements microscopiques of Ledermuller. Schœfer gives also figures of the scales in Pisc, Bavar and Pentas, and some are also to be seen in other Ichthyologists. I do not find that Broussonnet in his Memoire, inserted in the Journal de Physique, t. XXXI, p. 12, has added much to the reports of his predecessors.

There are some very thick, of quite a stony nature, which are but slightly imbricated, but very compact, and form for the fish a true cuirass, such are those of the lepisosteus, the birchir, &c.

In certain fishes, as the eel, the scales are not at all imbricated, and have all their parts equally incrustated under an epidermis rather thick; nevertheless they are sufficiently approximated.

In others, such as the turbot, and cyclopterus, there are scales similar to cones or tubercles more or less bristly, which adhere to the skin by their large base, and between which are naked intervals.

Similar scales, but reduced to very small points, cover the bodies of the greater part of the tetrodons. In the diodons these points become long thorns, whose base widens to support them as tripods.

The grains which make the skin of the scyllium and the majority of chondropterygians very rough, are also species of scales, and when they take the form of soft tubercles, which touch each other and which may be polished, they give it what is called the *galuchat*, an armour which belongs to the species of stingrays. There are some whose form and size make a complete buckler, such as are those of the sturgeon.

Those scales which are mostly developed, and which best shew their analogous nature to that of teeth, are those to which the name ray buckles has been given. Their base, which is oval and puffed, is hollow in the interior, and in them it penetrates the vessels which nourish a pulpy nucleus very similar to that of a tooth.

The cuirass of the ostracions is only formed of a collection of large scales or plates, whose edges are in contact, and thus become necessarily angular.

† It is the dermis which secretes beneath the scales the matter of a metallic silvery colour, which causes the brilliancy in fishes; it is composed of small polished lamina, like burnished silver, which are removed by washing either from the skin or from the scales, the under surface of which they varnish. It is well known that it is this matter with which false pearls are coloured. It is also secreted, in many fishes, in the thickness of the peritonœum and the coats, furnished to certain viscera, particularly to the natatory bladder*.

The scales are not equally spread, neither are they of similar form or consistence over the whole body. Frequently the head is deprived of them, and is only defended by the wrinkles and roughnesses of its bones, covered with a skin very thin and very closely adherent; but it also happens that they may have, according to their genera, scales upon the cheek, on the opercular pieces on the cranium, and even on the snout and jaws, and, lastly, on the branchiostegal membrane itself. The scales extend also more or less, on the fins, and even in the squammipennes. The dorsal and anal fins are covered in almost the same manner as the rest of the body.

The scales of the lateral line are distinguished from others by one or more small tubes with which they are bored, and frequently by other peculiarities. In the caranx, for example, they rise in ridges on both sides of the tail.

* See a Memoire of M. Réaumur upon this silvery matter, amongst the memoirs of the Academie des Sciences for 1816, p. 229.

It also happens that the scales of the inferior border of the belly being compressed, trenchant, and united together, present a species of external sternum, something in the form of a saw. This is seen in the herrings, and the serra-salmons.

The kind of integuments furnished by the scales being well adapted to facilitate natation by their smooth surface, and the little resistance they present to the liquid, and also to preserve the fishes from the clashings and friction to which they are exposed amongst the rocks which stick out from the depths of the sea, is but a slight guarantee against the impression of the variations of temperature; but the heat of fishes not exceeding that of the element by which they are surrounded, they have a less dread of cold than birds and quadrupeds; it is for the same reason that reptiles are only covered with scales or a naked skin.

Subsequently added in a Supplement by the Author.

Fig. VI. of the pl. vii. shows the silvered membrane, *l.*, raised on a part of the globe of the eye, to allow the choroid to be seen, *k*, and the vascular pad.

Fig. VII. shows at *c.* the external lamina of the cornea, which is a prolongation of the skin; *l.* is the iris lined above by the silvered membrane, and by the uvea below; *m.* the choroid; *n.* the ratinæ; *o.* the vitreous body. *a.* the semicircular horizontal canal; *b.* the anteaïor vertical; *c.* the posterior vertical; *d.* the ampullæ; *e.* the membranous vestibule; *f.* the sac; *g.* the union of the two semi-circular vertical canals; *s.* the various branches of the seventh pair, which proceed to the ampulla and the sac.

No. x. of plate viii. shows the four scales of the perch: *a* and *b* are the large scales of the sides; *c*, a scale of the lateral line perforated by a tube, and *d*, a scale of the back.

Figure 2 of plate viii. and of figure 1 of plate vii. show in *R* the natatory bladder. In the first it is in its right situation; it is perceived between the sides: in the second it has been, like all the intestines, lowered, in order to show the kidneys, *SS*, and the urinary bladder, *T*. Its sides are covered anteriorly with clusters of red pencilled lines, and vessels which form them, and posteriorly by the arteries which it receives from the deep-seated branches of the intercostals and veins which unite with those of the ovary.

It may likewise be added for the knowledge of figure 1 of plate vii., that in the orbit are seen the ophthalmic nerve, 5-1 the nerves of the third pair, those of the fourth and sixth pairs; that likewise is seen the superior maxillary, 5-2, the inferior maxillary, 5-3, the opercular nerve, 5-5, the nerves of the eighth pair in 8, the last branch of which is supported on the stomach in 8-1: 9, 10, 11, and 12 are pairs of nerves which go to the shoulder, arm, and pectoral fin: those of the ventral fin are supplied by the branches of the intercostal: 13, 14, 15, in *x*, *x*-1, *x*-2, are the apertures of the anus, ovaries, and bladder, situated, as is seen, in fishes in an inverse position to that of other vertebræ.

It may be added that the figure 4 represent the testicles *R*, *R*, and the bladder, *Q*; that figure 9 shows an ovary cleft longitudinally to

show the numerous membranous lamina of which it is composed, and which are lined at each of their surfaces with a number of eggs so considerable, that when they have acquired their natural development, they entirely hide the membrane to which they adhere.

CHAPTER VII.

*Organs of Nutrition of Fishes.**

The vegetative functions of fishes follow the same order as those of the other vertebrated animals; they seize and divide their aliment with the teeth; they make it undergo a first digestion in the stomach; passing from that organ into the intestinal canal, the food receives the bile which is poured out by the liver, and in some fishes there is an addition of a liquor which is analogous to the pancreatic secretion; the nutritive juices which are absorbed by means of vessels which represent our lacteals, and perhaps are partly taken up by the veins, are blended with venous blood; this is carried to the heart, and from the heart to the gills where the contact of the surrounding air converts it into arterial blood; the latter then returns to nourish the whole of the body; but the blood must also be carried out of the body in various ways, and this is effected by perspiration, by the various liquids that ooze from the skin and the kidneys, which produce urine.

We shall in this chapter describe the organs of mastication, of digestion, of circulation, of respiration, and then the excretions.

Fishes in general are characterised by voracity; we see them incessantly pursuing and devouring each other, or bolting small animals found within their reach; their ability, however, in this respect, will depend, it is obvious, on the opening of their mouth and the power of their teeth; if the teeth be sharp and crooked, they are then able to retain the most agile animals; if the teeth are large and strong, then can they grind down the hardest prey; but when the fish is furnished only with weak teeth, or utterly destitute of them, he is reduced to live on food which cannot offer the least resistance.

* The splanchnology and angiology of the perch are represented in plates vii. and viii. Figure i, pl. viii. represents a perch opened, showing the heart and abdominal organs, with the omenta in their natural situation. Figure ii, pl. viii. shows the same organs and the gills in their proper situation, and are seen on the left side, after raising the opercula, the bones of the shoulder, the muscles, and the peritonæum of that side: this figure was taken from a female whose ovary was quite full. The large figure of plate vii. represents a perch in which all the muscles and the peritonæum of one side are removed, and in which the opercular pieces and the other lateral apparatuses of the head and shoulder are detached and turned down; this shows the branchia quite naked, also the heart and the sinuses of the veins, with arteries which pass from the gills, the arteries, and veins of the trunk, and all the abdominal viscera, with their arteries and veins; a great portion of the cerebral nerves, and the first nerves of the spine are shown also, according to their distribution; the rest of those of the spine has been withheld, least the figure would be confused by a complication. This figure was taken from a female in which the ovary was very slightly developed. Figure iii. pl. viii. gives the intestinal canal and the liver, which are separated in such a way, as to display the distribution of the vena portæ and the gall bladder.

Fishes are not at all dainty in the selection of their food, and their powers of digestion are adequate to the solution of every thing that is endowed with life. They swallow other fishes, indifferent to the dangers arising from their spines and crests; crabs and shells have no terrors for them, and remains of this strange food have been found in the intestines of these fishes. They reject, however, all such indigestible matters, as birds of prey reject the feathers and bones of small birds which they have swallowed.

The species that live, principally, on vegetable food, constitute a very small proportion of the whole community; they are found particularly in the genus *smaris*, and in some other species which may be regarded as dismembered portions of this genus.

We should conclude, that digestion is a very expeditious process in fishes, and their growth depends, to a great extent, on the abundant supply of nourishment; they increase in size less rapidly in the smaller fish ponds, where they are too numerous, than in the vast lakes, where they find the necessary food.

The growth of fishes which attain longevity may exceed very considerably the ordinary limits of size; but, with the exception of some species brought up by man, we know very little about the natural duration of a fish's life, and hence it may be upon a conjecture very doubtful in its foundation, that the persuasion exists, that the life of a fish may be preserved for ever. The reason given for this opinion, which is, that the bones of fishes do not harden as much as the bones of warm blooded animals, at all events is not applicable to the greater part of fishes.

Manducation and the teeth in particular.

We have already explained in the the third chapter of the Osteology, the composition of the jaws of fishes, and the mode in which they perform, in concert with the hyoid apparatus and the gills, the motions required in order to enable them to seize their food and to swallow it.

We have now to speak of their teeth, by means of which their food is generally seized and transferred to the pharynx, or in rarer cases, where this food is actually carved and ground down according to various methods.

Fishes may have teeth adherent to all the bones which envelope the cavity of the mouth and pharynx: they have them to the intermaxillaries, to the maxillaries, to the palatines, to the vomer, to the tongue, to the branchial arches, and to the pharyngean bones, and there are some genera which have teeth in all these bones, either all uniform, or different to each other; but some or many of these bones may want teeth, and there exist fish which are altogether deprived of them.

The perch for example*, has teeth dense as the pile of velvet to its intermaxillaries, (No. 17); to its dentaries, (No. 34); to a transverse band in the form of a crescent under the anterior extremity of its vomer, (No. 16), to a longitudinal band in each palatine, (No. 22), which is even continued a short distance along the border of the

* See pl. II and III.

external pterygoid in (No. 24). It has them also at its superior (Nos. 61, 62), and inferior (No. 56), pharyngeans, and at all the tuberosities of its branchial arches; but they are absent on the tongue.

We describe the teeth in reference to their position, according to the bones to which they are attached. Thus we make a distinction between the intermaxillary teeth, maxillary, mandibular, vomerian, palatine, pterygoidean, lingual, branchial, and the superior and inferior pharyngeans.

Their forms are not less varied than their position, and give rise to epithets still more numerous; most frequently they represent cones, or hooks, more or less sharp; when these hooks are numerous and disposed in several ranges or in the form of a quincunx, they are compared to the points which are presented by cards for carding wool or cotton; frequently they are so thin and so dense, as to appear to the eye like the pile of velvet, and when they are at the same time very short, and also very dense, they then have the appearance of smooth velvet, but when they are elongated and weak, they form brushes or species of hairs. In short, these little delicate teeth may be at the same time so short, that they are reduced to a simple asperity more capable of being detected by the touch than by the eye. It will not be difficult for any person to comprehend the terms which we employ to describe these various shades of difference. Independently however of these teeth in hooks, there exist also trenchant ones in the form of a wedge, as the anterior ones of the genus *sargus* and the pharyngeans of the genus *scarus*. The trenchant may be dentated as in the genus *acanthurus*, or they may be sharply pointed in its middle, as in the *serra-salmons*. There are also round, or hemispherical, or oval, as the posterior teeth in sparrows; these round teeth are disposed in several rows, or compacted together like paving stones, as may be seen in the palate and tongue of *glassodenti* on the jaws of the ray, on the pharyngeans of *labrus*, and many *scienæ*. Some teeth also are pointed or compressed, and trenchant on two sides, as those in *trichurus* and *chirocentrus*; others with their crown flax, and raised in salient lines as those of the pharynx of the carp, or which rise in a mass as those of the pharynx of many cyprins. There are some teeth again with tubercles on the crown, as those of *myletes*, &c.

All these teeth are simple, and are produced likewise from one simple pulpy germ.

Whatever be the form of the teeth, the growth of the simple ones is always the same, and is accomplished by successive layers, as is the case with the teeth in mammalia; but the growth does not proceed at any time so far as to form a root which would descend into the socket. The teeth of fishes like those of the monitors and many other saurians, consist only of that part called the crown, and when this crown is completely formed, the pulpy nucleus on which it exists becomes ossified; when the tooth is about to fall, it breaks, and is detached from this ossified nucleus which remains, and being united to the jaw forms a part of it; in some species however, as in those of *anarhicas*, the osseous nucleus now become larger than the tooth, and forming a prominence on the jaw, is detached exactly as the stag's horns, and probably by

the same sort of mechanical process, and it falls with the tooth which it supports.

The renewal of the teeth continues during a considerable portion of life, and according to all appearance, there is tooth for tooth, which come at very uncertain periods, as happens in the leaves of green trees.

The new tooth sometimes grows beneath, sometimes at the side, or behind or before the old tooth.

In the replacement, which takes place vertically, and which particularly takes place in the round teeth, when the ossified nucleus of the old tooth is united to the jaw, it is nourished by it, and its texture becomes cellular; its cavity is filled, and when the crown is detached, the surface of the bone is continued; but deeper still is a cavity, where the tooth that is to replace the old one begins to be formed: it penetrates at the proper period the surface of the bone, and undergoes the same changes as its predecessor.

The renewal of a bone by the side is peculiar to the great conical or hooked teeth and also the trenchant ones, the new tooth pierces the bone on the side of the old tooth, but the latter does not fall the less by rupture as usually takes place.

Amongst the singularities connected with the dentition of fishes, we may set down those of the pharynx in cyprins, in the jaws of the scarus, and in those of the tetrodons and diodons.

The cyprins have no teeth, except in their inferior pharyngeans, which surround the sides of the pharynx like half collars; these teeth are few but very strong; on the superior surface there is a triangular plate of dentary substance or enamel, but very hard, and is commonly called carp stone; it is enched, and looks as if it were set in a dilatation of the basilar bone. It grows by layers formed on the surface that touches the bone, and it is against that, that the inferior pharyngeans compress and bruise the food.

The jaws of the scarus have nearly the external form of a parrot's beak; there are little holes at their base by which the teeth, the germs of which may be seen in the interior, can come out to fix themselves on their surface, on which the preceeding teeth already had formed small warts in quincunx; (a) they are carried also very gradually towards the edge where they become endowed with activity, and then those which have preceded them in this situation fall in consequence of detrition.

Upon the pharyngeans of these fishes the teeth are trenchant, and grow vertically and in a quincunx on the surface of the bone; so that according as the old ones are worn the new ones come up behind them.

The same process occurs in the pharyngean teeth of labrus, with this single difference that they are round instead of being trenchant.

☞ (a) *Quincunx* is a term borrowed from gardeners, and which is thus explained. One row of plants is placed sixteen inches from the end of the plot and sixteen inches apart, a second row is placed twenty-two inches and a half from the end and fifteen inches apart, the third row is placed fifteen inches from the end and fifteen inches apart, and the fourth row again is twenty-two inches from the end and fifteen inches apart. The plants then will form rhomboidal squares.—ENG. ED.

The jaws of the tetrodons would very nearly resemble the pharyngean bones of scarus, were it not that each of these teeth, or rather of these lamina, occupies the whole breadth of the bone. The posteriors are the most recent and the anteriors the most worn.

In the diadons there are two series of lamina, the one forming the margin of the jaw, the other series forming a disk situated more behind, and separated from the margin by a very shallow depression; they succeed each other, and in such a way, as that in the disk the posteriors are always the most recent, and in the edge the superior.

But the common character applicable to these two forms of dentition, is that the entire jaw is only armed by two or even a single compound tooth, the lamina of which grow by the transudation of the pulpy lamina, which are interposed between them, and are then united by the same mass of enamel.

The chimera has compound teeth like the two genera we have spoken of, but they are generated and grow on the germs, like threads instead of lamina, and their interior tissue is pierced with fine tubes like a rush, or the teeth of an orycteropus. There are four plates in the superior jaw and two in the inferior.

The flat and broad teeth of mylobates (fishes belonging to the family of the rays) are also compound, so far, at least, as their substance is formed on a vast number of pulpy filaments, and is invested with the enamel common to the whole.

The teeth of the lamprey are thin horns, moulded on the fleshy germs; and there are various forms and directions on the lips, on the jaws, and on the tongue; to these we shall afterwards return.

In the squalus with trenchant teeth the nucleus of the tooth is permanently cartilaginous, and is for a long time flexible, so that the new teeth, which always grow up behind the old ones, remain in the species where they are trenchant, as in the white sharks, in layers behind, and sometimes even superposed upon one another in several ranges. They rise up and the base of their nucleus assumes a consistence when the time has arrived at which they must become active.

There are some species of squalus in which a portion of the teeth is flat, and broad, and compound, like those of mylobites.

In particular articles we shall enter into the detail which may be necessary for giving a description of the dentition of each fish.

Deglutition.

In the greater part of osseous fishes,—besides the lips, which even when they are fleshy and have no muscles proper to themselves, must of necessity be without the power of retaining the food in the mouth,—we find generally within each jaw, behind the anterior teeth, a sort of membranous veil, or little valve formed by a fold of the internal skin and directed posteriorly, the effect of which must be to impede the food, and especially the water that is swallowed for respiration, from running back by the mouth.

The food, seized by the teeth of the jaws, retained by this little valve, carried further behind by the teeth of the palate and the tongue when they exist, is prevented by the dentations of the branchial

arches, from penetrating into the intervals between the branchiæ, where it might wound organs so delicate as those of respiration. The movements of the jaw and the tongue cannot make it penetrate into any other way than that of the pharynx, where it again undergoes a new action from the teeth of the pharyngeal bones, which triturate it or carry it further back as far as into the œsophagus.

It cannot be said that there is, in all this passage, any organ which resembles the functions of the salivary glands: certainly the cyprins and some other genera have the palate furnished with a thick layer of a soft red substance, furnished with very numerous nerves, and which are irritated by the least percussion; it oozes, from the surface, a slight mucus, from imperceptible pores; nevertheless, I do not from this circumstance, see a salivary gland, or even a gland at all. It is a particular tissue, very sensible, and which is probably destined to exercise an office more or less analogous to that of taste.

The œsophagus is lined with a layer of strong muscular fibres, compact, and sometimes forming various fascia, whose contractions push the alimentary bit towards the stomach, and it is in this manner that it is completely swallowed; for the œsophagus of fishes is necessarily very short in the greater part of the species, since they have no neck.

Nevertheless there is sometimes in the thickness of the walls of the œsophagus a glandular substance. It is very apparent in the ray.

The Intestinal Canal.

The viscera of digestion are enclosed in the abdominal cavity, which is separated anteriorly from that which contains the heart, by a kind of diaphragm of small extent, formed of a lamina which gives off the pericardium, and of another which appertains to the peritoneum; the diaphragm is deprived of proper muscles, but reinforced by the aponeurotic fibres between the two lamina, and receives nevertheless some action from one of the muscles of the branchiæ: the great venous sinus occupies a part of its thickness. Another cavity exists along the spine, and contains the kidneys and aerial bladder; the peritoneum separates it from the abdomen properly so called, and at the same time, as in other animals, it is folded within the abdominal cavity, to embrace and suspend the viscera which it contains, and which are the intestinal canal, the liver, the spleen, as well as the pancreas when it exists. The organs of generation and the urinary bladder are generally enveloped in folds of the peritoneum, and lodged in its interior; but, as we have just said, the kidneys, and even most frequently the natatory bladder, are without and covered on the side of the belly only, by the peritoneum.

One thing very remarkable is that there are many fishes, such as the ray, the squalus, the sturgeon, the lampreys, and the salmon, which have on the sides of the anus two holes which penetrating into the abdominal cavity, in such a manner that the anterior lamina of the peritoneum continues with the epidermis, and appertains to the order of mucous membranes; two other holes, at least in the ray and

squalus, extend even their continuity as far as the pericardium, and along all its internal lamina*.

The intestinal canal is composed of the same tunics as in other vertebrated animals, and the variations which they undergo in their respective thicknesses and their different folds, are analogous to what is seen in the higher classes, and are not less numerous: it has valvulæ conniventes and internal papillæ of different forms, also coriaceous indurations and wrinkles in various directions. The fleshy fibres are reinforced or they become weak; sometimes a glandular tissue is placed between the membranes, &c.

The internal folds of the œsophagus are usually longitudinal: its cavity is continued in a right line to the bottom of the cul-de sac of the stomach; sometimes even, as in the cyprins, and labrus, the stomach has no cul-de sac, and is merely a slight dilatation of the canal which scarcely deserves the name of stomach; but, very often, it is curved, or it is directed from a part more or less adjacent to the entrance, and from the right side a branch at the extremity of which is the pylorus. This branch, which is transverse and even ascending, assumes, sometimes, as in the grayling and the mullet, such a thickness in its fleshy tunic that it constitutes a true gizzard, of which the ordinary stomach represents in such a case, the crop.

The size of the sac forming the stomach, the proportions of its length and breadth, the thickness of its walls, its wrinkles, &c., are infinitely varied, and the description of them could only properly find a place in the individual histories of the species.

The intestinal canal is more or less long, more or less broad, and forms also more or less folds: its walls vary in thickness, villousities are more or less marked according to the species. Thus one fish, as the lamprey, has all straight, others as many of the percoides, form only two or three folds, and the third, as the hypostome has it as thin as a cord, and sufficiently long to exceed many times the length of its body. But these are details for individual histories to enter upon.

There is generally on the side of the anus a small valve, separating the posterior from the anterior part; but, in very rare instances only, is this posterior portion beyond the size of the other, and, in no instance, has it a cœcum as is found in the quadrupeds.

One of the most remarkable folds that has hitherto been observed in the intestines of fishes, is the little spiral valve of the rays, of squalus, and the sturgeon; and of this valve vestiges are found even in the lamprey.

Close to the pylorus in a great number of fishes will be found blind guts, and these often in a considerable number, and of which the velvety surface, folded into dense meshes, would appear to furnish in a great abundance a glary liquid, which is regarded as having a resemblance to the pancreatic juice, and which is so much the more beneficial, since fishes, as we have already mentioned, are generally without salivary glands†.

* Munro, *Anatomy of Fishes*, pl. 1. fig. 5, No. 28, shows the openings of the abdomen, and plate 2, fig. 1, Nos. 22, 23, those of the pericardium in the rays; pl. 8 shows those of the abdomen of the sturgeon.

† M. Rathke is of opinion that the spungy substance in the palate of the carp and

But the greatest number of these is found in the family of the scombres; the cods have many of them; other fishes, as those of the labrus, silurus, cyprins, and pike, are entirely destitute of them; others, as the perches and pleuronectes have them short, and very small in number; river perches have only three, the pleuronectes only two; in the sturgeon they are numerous, but still short and united by vessels and cellular tissue, in a mass which constitutes just a shade of difference between their usual state of freedom, and the compact pancreas of the rays and the genus squalus. In the sturgeon each of these appendices has a communication by means of an appropriate orifice with the canal. In the rays and squalus, as in the quadrupeds, the pancreas is a true conglomerated gland, which secretes its fluid by a common canal.

The anus has some very singular varieties in its position, and does not depend upon that of the ventral fins in this respect; still it is always situated more behind than these fins, but when they are under the throat or when absent, the anus is itself supported frequently beneath the throat: it is never behind, farther than the base of the tail, while the abdominal cavity is often prolonged into one or two sinuses on the ridges of the tail behind the anus.

To give a particular example of the arrangements of the alimentary canal, we shall mention that in the perch, it consists of an œsophagus (*A*), which is short, of the form of a siphon, which opens immediately into a stomach (*B*), formed like an obtuse bottomed sac. Internally, the œsophagus has dense wrinkles covered with very fine velvet, and which, in the stomach, are changed into larger wrinkles; these are salient, irregular and folded across, and amount in number to seven or eight; from the right side of the stomach towards the middle of its height a short branch is given off (*C*) of the same nature as the stomach itself, but much more narrow and with wrinkles only amounting to four or five.

It is at the extremity of this little branch that we find the pylorus, which is a very delicate constriction, and below it is the velvet surface which is prolonged into a sort of annular little valve, thin and indented at its margin, and it prevents the return of the food from the intestine to the stomach.

Around the origin of the intestine, three blind guts or cœcal appendages (*D, D, D,*) adhere; they are much thinner, and a little longer than the branch of the stomach which they surround.

They communicate with the intestine by many little orifices situated behind the little valve of the pylorus. Their internal membrane is stuck with little fringes, or with small narrow and acute slips, the bases of which adhere to one another, and form a sort of net-work; it oozes out a very copious mucous secretion.

The intestine forms two folds, which proceed at first behind along the left side, (*E, E,*) as far as the middle of the abdomen, returning suddenly towards the stomach by (*F, F*), and then taking a curved direction in its course to the anus, it describes an oblique line, (*G*).

some other fishes, is a sort of salivary gland; and it is only in fishes destitute of pyloric appendages that he has found this substance.

The intervals are occupied by the spleen, (*H*); this is placed in the first fold by the ovary (*K*), which is often very voluminous; and by the vessels, and lastly, much of the fat poured out by a cellular tissue, produced by the peritoneal envelope, and which represents in some respects the omenta of mammalia.

This intestine decreases slightly in its diameter, as far as the middle of its last line, where a very perceptible swelling marks (*L*), the commencement of the large intestine or rather the rectum. There is also, internally, in this place a circular small valve, formed by a very slight fold of the internal membrane, which prevents the matter that have once descended in the rectum from getting back again.

The spleen in fishes (*H*), is variable in position, volume and size, but it is always present and as invariably solitary; most frequently it is near the middle of the folds of the intestinal canal. It only receives, as in the superior animals, arterial blood which it elaborates and transmits to the liver, where it sends also the blood of nearly the whole of the remainder of the intestine; its relative positions with the stomach differ very considerably, and very often too, from what we see in the mammalia, and we cannot attribute to it any function which would constantly arise from the greater or less extent of the pressure of the stomach upon it.

The liver (*M*), is generally large, and is situated more towards the left than the right; its figure and the number of its lobes are very various, and this number is sometimes even excessive; but it is always furnished with a gall bladder (*N*), which is sometimes moderate in size, sometimes very long, and suspended at some distance from the liver. The excretory canal (*n*), is inserted in some high point in the intestine, and sometimes even in the stomach. The latter I have seen in the moon-fish. The hepatic canals (*m*), are sometimes very numerous, and they are joined successively to the cystic canal.

The substance of the liver is softer than it is in many quadrupeds and birds, and its tissued is almost always penetrated with a copious oily substance.

The mesentery of fishes is altogether imperfect, and is frequently reduced to mere bands surrounding the vessels and nerves and connecting the peritoneum, with the peritoneal coat of the canal.

It is very common for this tunic to be prolonged in appendages filled with oleaginous grease, and which are really nothing but omenta, (*P*, *P*).

In the mesentery we can never find conglobate glands, and it has always its lacteals as other animals.

Indeed, the absorbent system in fishes does not appear to be less than in the other vertebrated animals*, and it is certain at all events, that those of the intestinal canal are uncommonly numerous, and

* William Hewson and Alexander Munro have had a contest respecting the priority of the discovery of lymphatic vessels in the oviparous vertebrated animals. Munro is positive that he has seen them in birds in 1758, 1759, and 1760, and mentioned them in 1767; also that he discovered them in the ray, 1760: and in the tortoise in 1765; this was published in 1770. Hewson's Memoir on the lymphatics of birds in Philosophical Transactions was 1768, and on two of the reptiles in 1769.

very often form dense meshes, and in several, layers. By means of injections we can follow them upon the borders of the valvulæ conniventes, and other internal folds of the velvety surface. They terminate by various trunks in the great venous sinus or in any of the principal veins which approach it.

There is no difficulty whatever in obtaining a sight of these of the other parts, and M. Fohmann has injected those of the branchiæ amongst others with success; we should, therefore, conclude that nature adopts in this class the same contrivances for absorption, as in the other oviparous vertebrated animals*.

Circulation†.

Fishes have, as well as warm-blooded animals, a complete circulation for their body, another equally complete for the respiratory organs, and a peculiar abdominal circulation terminating in the liver by the vena portæ; but their appropriate character consists in this, that their branchial circulation has alone at its base a muscular apparatus, or a heart corresponding with the auricle and the right ventricle of the animals just mentioned, and that there is nothing at all like it at the base of the circulatory system of the body, that is to say, that the analogues of the auricle and right ventricle are entirely wanted, and that the branchial veins are converted into arteries without being enveloped with muscles.

* See the fine work which M. Fohmann has just published on the lymphatics of fishes, forming a first part of a general history of these vessels in the vertebrated animals; Heidelberg and Leipsic, 1827, in folio. He represents them in the torpedo, in the eel, pike, and some portions of silurus and anarrhicus, and of the cod and salmon. Munro gave a representation of those of the ray in his *Anatomy and Physiology of Fishes*, pl. 18, 19.

† Duverney, in his *Memoirs of the Academy* for 1791, and in his *Works*, vol. ii. p. 496, and pl. 9, has described the whole of the apparatus of the circulation and respiration of fishes, and makes a calculation of the frightful number of perceptible parts of which he composes it; in those of 1699, he has given a very particular description of that of the carp, which is also to be found in his *Works*, *loc. cit.* p. 470.

Munro, in his *Anat. and Physiol. of Fishes*, has represented the principal trunks of the vascular system in the ray; the branchial veins and arteries of the body which spring from them, pl. 1; the great venous sinus and branchial arteries, pl. 2; the abdominal arteries and the vena portæ, pl. 3. Kœlreuter has given the figure of the heart of a sterlet. (*Nov. comm. petrop.* vol. xvi. p. 14). Vicq d'Azyr in the *Mem. des Sav. Etr.* vol. vii. pl. 7, gives very badly the barbel and plaice. There is a treatise, ex professo, on the heart of fishes by M. Tiedemann (in German, Landshut, 1809), with figures of the hearts of the ringed ray, of the bukeled ray, of the white ray, of the shark (*squalus*), the emissole (*mustellus*), the sturgeon, conger, murena, otter-pike, lote, sole, barbel, scorpena, the arcuated chætodon, of one of the barbel, sciæna, of the saurel, orphi, of the fistularia, of the lauricaria, of the grayling, of the trout, sea-trout, huch, mullet, pike, carp, and another barbel. See also on the heart of fishes, Peyer, *Miscell. ac. cur.*, dec. 11. ann. 1. p. 201, taken from the salmon. Muralt, *ib.*, p. 124, of the lote; Collins, pl. 15, fig. V, of a salmon. Al. Munro *Anat. and Phys. of Fishes*, pl. 18. fig. I and II of salmon; pl. 22, fig. I, of the cod. Koelpin, *mem. de l'acad. de Stockholm*, in 1769, of the sword-fish. G. Needham, *De Biolychnio*, and Valentin, *Amph. Zoot.* vol. 2, p. 122, of the pike. J. Plancus, *Comm. bonon.* vol. 2, pl. 11, p. 297, of tetrodon mola. Doellinger, *Memoires de la Societe de Vetteravie*, vol. 2, second part, pl. 13, fig. I, of the carp.

This muscular apparatus of their circulation* is composed of an auricle (α), of a ventricle (β), and of the bulb of the pulmonary artery (γ), and the auricle is preceded by a large sinus (δ), in which all the veins of the body terminate. This arrangement makes four cavities separated by so many constrictions, which the blood must successively pass through before it can get to the branchiæ. The whole of it is small in comparison to the size of the body, and does not increase in the same ratio as the individual to which it belongs. Three of these receptacles, the auricle, heart, and bulb are lodged in the pericardium, which is, itself, placed beneath the pharyngean bones and between the inferior parts of the branchial arches, and adheres most commonly to the exterior by the humeral bones. Still its position is varied, sometimes in the chondropterygians, and especially in the lampreys.

The great venous sinus (δ) is not in the pericardium, but between the posterior wall of their cavity, and the membrane which fills the place of the diaphragm, and which is only the anterior part of the peritoneum strengthened by aponeurotic fibres.

This sinus is extended transversely, and receives by numerous trunks the veins of the liver, the organs of generation (ϕ), the kidneys (ψ), the fins, branchiæ, and neck, and lastly, the veins of the head (ω), which themselves pass partly by a sinus (ρ) behind the cranium. It sends all the blood by a single orifice of its anterior convexity into the auricle (α), which is open at its posterior part to receive it. Two thin membranous small valves are alone supplied to this communication, as will be naturally conjectured, directed towards the auricle.

The auricle (α) is in the pericardium anteriorly to the great venous sinus, and above the ventricle, or in other words, on the dorsal surface.

Its configuration is very varied and also quite fantastic; it is in general larger than the ventricle and overlaps it; still its walls are thinner, though they may be also of numerous fleshy columns.

Its orifice pierced in its inferior surface is directed to the ventricle (β), through the medium of the superior surface of the latter, and is furnished with two small valves, which are analogous to the mitrals of man, but their attachments are much more simple.

The ventricle (β), at least in the osseous fishes, is generally in the shape of a tetrahedron; sometimes it is oblong or very nearly oval; in the cartilaginous fishes its form is rounded, and frequently depressed.

It is below the auricle; its cavity is turned round in such a way as that being nearly vertical in the part which communicates with the auricle, it becomes horizontal and longitudinal in order to terminate at the bulb (γ). Its walls are very vigorous and fortified on the inside, with powerful, fleshy muscles; its substance is formed of two very distinct layers; the internal has the fibres more transverse, in

* The heart is seen in pl. 7, fig. I, laterally; and from below, pl. 8, fig. I: the sinus and auricle open above, pl. 8, fig. VIII; the ventricle and bulb open below, pl. 8, fig. VII.

the external they are more longitudinal, and their union is so very slight that a solution of continuity, which has all the appearance of a ventricle, is formed pretty frequently between them, but which is shut in every part, and is not even inside lined by a membrane*.

The most vigorous of the fibres are in the bulb (ν) of the branchial artery, the greater part having a circular arrangement; the name of this part is derived from its form; its communication with the ventricle is supplied sometimes with two, sometimes with three membranous valves; but, frequently, in its interior, particularly in the cartilaginous fishes, there are other ranges of small valves, and sometimes even these valves are fleshy.

The prolongation of this bulb proceeds from the pericardium, and becomes the branchial artery (ϵ), which is supported before as it proceeds beneath the azygos chain of small bones which unites the branchial arches.

The branchial artery is divided more or less immediately, but in such a way as to give a branch to each branchia.

This branch (ζ) proceeds in a furrow which is excavated along the convexity of each branchial arch, and more externally than the vein which follows it in the same way but in a different direction.

To this arch are attached a large number of parallel leaflets, usually terminated in a forked point, and sometimes very deeply divided; the great branch which goes in the furrow of the arch gives off a branch (η) to each of the leaflets, and this branch after having been twice bifurcated supplies an infinite number of small branchlets, which creep across on each surface of the leaflet, and terminate by being converted into minute veins; these small veins on each side are lost in a branchial vein (ϑ) which proceeds along the internal border of the lateral lobe of the leaflet, and the two veins fall into the trunk and great vein of the gill (λ) which is carried in the same furrow of the artery, but more deeply, and which proceeds, besides, in a contrary direction, that is to say, that the branchial artery coming from the heart and from the ventral side, diminishes in proportion as it ascends towards the back, and also that it furnishes small arteries, whilst the branchial vein, on the contrary, receiving by the small veins and other veins of the leaflets, the blood of these little arteries, increases in proportion as it is carried towards the back.

The rays have only two veins for each branchia which are not united until after they pass out.

The branchial veins, on leaving the dorsal side of the branchiæ ($\mu \mu$) assume the tissue and functions of arteries. The anteriors had already sent, before leaving the branchia, several branches to several parts of the head, and it is to be remarked, that the heart and many places under the chest, receive their blood from a branchial vein by a ray which it sends to them near its origin, and, consequently, long before its departure from the branchia. Still it is

* M. Dollinger has described it in the cyprins. I have seen it very plainly in the great sword fish. M. Rathke thinks, and in my opinion with some reason, that it is produced by the commencement of decomposition.

only a union of trunks given off by the four branchiæ, which are formed by the great artery that carries the blood to the viscera ($\pi \pi$), and to all parts of the trunk, and which is, therefore, the representative of the aorta in the mammalia, but an aorta that is destitute of any auricle or ventricle.

Thus, then, the left cavities of the heart of the mammalia do not exist in the fishes, and they are replaced by a simple vascular apparatus, which is situated above the right branchiæ as the right cavities are situated below it.

As has just been observed, the arteries of the head ($\epsilon \epsilon$) arise from the branches which spring from the two first branchiæ before they are united in one trunk. This trunk itself, which is the principal aorta, gives, from its origin, a large branch for the viscera ($\pi \pi$), which is variously distributed, according to the species, to the liver, stomach, intestines, spleen, genital organs, and natatory bladder: then this trunk ($\sigma \sigma$) follows the direction of the spine, and buries itself in the rings which are under the vertebræ of the tail. In its passage it gives branches, right and left, to the kidneys, in the intervals between the ribs, and, in general, to the muscles of the trunk.

The blood thus distributed to the head, trunk, branchial apparatus, genital organs, and swimming-bladder, is returned to the heart by the great venous sinus (δ); but, with the exception of some branches, that of the stomach, intestines, and spleen, goes to the liver by the vena portæ (λ), which varies at least as much as the artery of the viscera, either by the number of its principal branches which unite all its smaller branches, or by the number of trunks by which it penetrates into the liver. There are even species, as the cyprins, whose liver interlaces its lobes with folds of intestine, and in which the blood of the intestinal canal directly terminates in the liver in many small branches, in which nothing can be traced that may be considered as the trunk of the vena portæ*.

An essential observation must be made here, and which corresponds with what Mr. Jacobson has observed in birds, namely, the existence of a sort of renal portal vein, but which is subject to the same objection; the blood from a considerable portion of the muscles of the trunk passes into the great vein which runs into the vertebral canal above the spinal marrow, and, as this vein does not terminate anteriorly in the great sinus, but has a great number of lateral branches which penetrate the kidney, we may believe that it does not carry the blood, which it receives, to the heart, but that it distributes it in the kidney as the vena portæ distributes its blood in the liver. Nevertheless, as the portion of this vein which is placed behind the abdomen communicates by lateral branches with the vena cava which passes under the spine, we may believe also that it returns to the rank of ordinary veins.

Respiration.

The blood of fishes undergoes the influence of the surrounding fluid, by an almost infinite sub-division of vessels on the surface of the laminæ of the branchiæ. This liquid is water, and the fish is in-

* See the Memoire of M. Rathke, in the Archives Physiologiques of Meckel, 1826, No. 1, p. 126, for the distribution of the vena portæ of fishes.

cessantly engaged in making it flow to, and pass between, its branchiæ, by the motion of its jaws, and of its opercular and hyoidean apparatuses, such as we have described them above. This process, respiration, is as indispensably necessary to fishes as the respiration of air to other animals; they exhibit the same symptoms of distress when it is stopped, and very rapidly perish. Still the action of the water on the blood is far more feeble than that of air; it is not by itself, neither is it by oxygen, which enters into its composition, that the water acts; it is not decomposed, and it is only the small quantity of air that it keeps in solution and mixes with itself, which serves for the respiration of these animals: if it be deprived of air by boiling, it kills them instantly; it is even necessary for some fishes to come up to respire the air in its natural state, especially when the water in which they live is exhausted of it. We have very conclusive experiments on this head, and it is only necessary to remove certain fishes from the surface of the water by means of a diaphragm of gauze to asphyxiate them*.

In this respiration, as in that of the higher animals, the atmospheric air, as well as the air contained in the water, loses its oxygen(a).

* Spallanzani has shown that fishes absorb oxygen and convert it into carbonic acid. M. Silvestre has shown that they respire atmospheric air, or that which is contained in water. M. M. De Humboldt and Provencal, applying to this question the processes of a perfect chemistry, have obtained the results spoken of above. Their memoir is inserted amongst those of the Society of Arcueil, vol. xi. p. 339, et seq. and in the Zoolog. Observ. of M. De Humboldt, vol. xi. p. 294.

☞ (a) In their character of cold blooded animals, the fishes have been subjected to more extensive enquiries and experiments than any other of the cold-blooded orders. Spallanzani, Silvestre, Humboldt, Provencal, Priestley, Edwards, and others, have made this class the object of their minutest attention.

Priestley, who imagined that the principal use of the blood and lungs in man and other mammalia, was to eject phlogiston (1) from the system, thought that it would be interesting to find out if fishes gave any of this phlogiston to water.

With this view he put two (a large perch and an eel) into a pail of water; and when they had been in it about twenty-four hours he nearly filled a large phial with the water, and in it he agitated a small quantity of common air between six and seven minutes, and found that it was considerably injured by the operation; for two measures of this and one sixth, and by standing several days were never less than two measures. But when he agitated an equal quantity of air in the same quantity of the same water in which no fishes had been confined, and for the same space of time, it was not injured in the slightest degree. It is evident, therefore, according to Priestley, that phlogiston is discharged from fishes as well as from other animals; that this phlogiston affects the water, and this water the air that is agitated in it; and in the same manner as the fishes themselves would have affected it, if it had been possible for them to breathe it. Other experiments confirmed and extended these conclusions. Having filled a phial with some water from the hot well at Bristol, which he found to contain air in a great state of purity, he put a few minnows and other small fishes into it, about two inches in length, and confined them without any access of common air until they died. He then took equal quantities of the foul and of fresh water, and expelled from both all the air they would yield. That from the water in which no fishes had been put, or the fresh, exceeded the foul in the proportion of three to two; and by the test of nitrous air, the former

(1) Phlogiston was the name of a combustible principle supposed to exist in all bodies, and that when burned, these bodies gave out the principle. But Lavoisier's discovery of oxygen gas exploded phlogiston.

Upon the whole, the absorption of the oxygen is very feeble, and it has been computed that a man consumes fifteen thousand times more air than a tench.

exceeded the latter in a still greater proportion. The fresh was about the standard of common air, and the foul somewhat worse than the air in which a candle just goes out: it might have been worse, but the water remained in an open vessel all night before the experiment. Hence, air contained in water in an unelastic state is as necessary to the life of fishes, as air in an elastic state is to that of land animals.

He then had no doubt but that putting fishes into water impregnated with air thoroughly phlogisticated would be equally injurious to them, as this air in an elastic state is to land animals; and this was verified. He began with rain water which contained no air, having been recently boiled. He put nine small fishes into a vessel containing about three pints of it, and they lived between three and four hours, no air having been admitted. Two fishes were put into a pint of it impregnated with phlogiston from air that had been phlogisticated six months before by means of iron filings and sulphur, and they lived in it nearly an hour. It was very imperfectly impregnated. Inflammable air had a similar effect. John Hunter having informed him that fishes would not live in water impregnated with fixed air, he tried it, and found that small fishes would not live in it more than a few minutes. It is well known that all spa waters containing fixed air are fatal to fishes, frogs, and insects. He found that in water impregnated with nitrous air they were affected in the same manner, but more violently; but as a decomposition of some small part of the nitrous air might take place before he could possibly slip the funnel into the neck of the phial, he introduced the fishes into the vessel in which he had impregnated the water while it remained inverted in the basin, the remainder of the nitrous air not imbibed by the water still resting upon it. The phial contained something more than a pint, and the nitrous air occupied about one-fourth of it. Into this vessel he introduced two small fishes, and they continued very quiet, without being seized with any convulsions (as happened before), ten minutes, or a quarter of an hour, before they died. Hence, the cause of the convulsions, in the former experiment, arose not from the *nitrous air*, properly speaking, but *nitrous acid*, which acted like the fixed air, another kind of acid. Whereas now the fishes were no otherwise affected than in water with phlogisticated or inflammable air, except that the water had imbibed more of the nitrous air, and hence was sooner fatal to them.

Broussonet, a French chemist, was the next who made experiments on fishes.

On the 20th of June, 1784, Broussonet put a couple of ten-spined stickle-backs (epinoches) into some water at a temperature of 14 degs. This was gradually heated, and at the end of two hours and a half the thermometer mounted to 28 degs.: the fishes then became agitated, but on being cast into fresh water they became well again in a few minutes.

On the 10th of November, 1784, he put a carp, some bleaks, gudgeons, and perch, into some water of the Seine at 5 degs., and the bottom of the vessel was covered with sand. At 25 minutes past twelve o'clock the thermometer was at $6\frac{1}{2}$ degs.; at 30 minutes at 8 degs., &c. This experiment lasted till 45 minutes past four; and he marked the degrees of heat every five minutes, pouring some fresh water into the vessel at different times in small quantities. At 12 degs., the smallest fishes began to rise to the surface of the water, became agitated and ill; yet the Seine water is much warmer in the summer. At 21 degs. the small bleaks were nearly dead. At 22 degs. the perch were motionless and reversed. The gudgeons, which were of a larger size, did not appear to suffer till 23 degs.; whilst the carp was not at all agitated, its respiration being only more frequent. At 28 degs., at which point the water was kept 15 minutes, the carp began to lose its equilibrium, and became ill; it afterwards appeared dead, and only came to itself again after being left a long time in fresh water. Broussonet employed four hours and a half in bringing the heat of the water to 28 degs. He is of opinion that, with certain precautions, fish would live in a water heated beyond 28 degs.

But the experiments on which the greatest reliance is deservedly placed, are these of Sir Humphrey Davy, who resolved on ascertaining the truth of the power which had been long attributed to fishes, namely, that they could decompose water into oxygen gas. The following is an account of his experiments.

All this oxygen does not return under the form of carbonic acid ; there always remains a little in the body of the fish, which likewise

1st Experiment. He expelled, by long boiling, the atmospheric air from 64 cubic inches of sea-water : he then excluded it from the air by means of mercury. Having then introduced a small mullet, it was instantly convulsed, and died in a few minutes.

2d Experiment. A quantity of water was freed, by boiling, of its atmospheric air : two receivers, each of the capacity of 36 cubic inches, were filled with this water : into one of these two cubic inches of nitrogen were introduced, into the other two of phos-oxygen. By long and constant agitation the gasses were dissolved by the water, which was excluded from the contact of air by mercury. Into each of the receivers two minnows were introduced. Those in the water holding nitrogen in solution died in about four minutes, those in the water holding phos-oxygen, in solution appeared totally uninjured, and when examined, after some hours, were still alive and healthy.

3d Experiment. The same receivers used in the last experiment were filled with distilled water freed from atmospheric air by a second boiling. Into each of these three cubic inches of phos-oxygen were introduced. The receivers were then agitated for some time, till the water in each of them had dissolved an equal quantity of gas ; they were then inverted in a trough of mercury, so as to exclude atmospheric air from them. Four minnows were then conveyed into one of them through mercury. The receivers were now suffered to remain untouched for six hours, when they were examined. The minnows were alive, and no gas remained in the top of the receiver in which they had respired. The gas in the top of the other receiver remained nearly the same as at the commencement of the experiment. A quantity of lime-water was poured into each of these receivers ; in that in which the fishes had existed there was a very perceptible cloudiness, occasioned, as Davy supposed, by the formation of carbonat of lime ; in the other there was no perceptible change.

From these experiments Davy concludes, that the venous blood in the gills of fishes is phos-oxylated by the phos-oxygen held in solution by water ; and that carbonic acid, and probably water, are given out as excrementitious by the venous blood in their gills. With respect to the decomposition of water by fishes in respiration, as there is no evidence of hydrogen being formed, there can be no reason for the supposition.

But the most interesting of the experiments made on fishes, were those of Dr. Edwards, in Paris, whose work "*Influences des agents physiques*," is referred to in a note by the author.

Dr. Edwards, during a series of experiments, the philosophical results of which have not been exceeded since the days of Spallanzani, has proved that fishes are affected precisely in the same way as reptiles by the privation of air. He also proved that the former like the latter, could not bear an increase of temperature. The only difference between the two orders of animals in this respect is, that the fishes are influenced by this privation according to their size. The younger the fish and the smaller, the less capable is it of bearing an elevation of temperature. After varying in his experiments, the temperature and the quantities of water with which air was mixed, he found from the results, that the following laws were established.

1st. That the duration of life goes on increasing with an increase of the quantity of aerated water, the temperature remaining the same.

2nd. That the same result takes place when the quantity of water remaining the same, we lower the temperature.

3rd. That the duration of life remains the same, when, within certain limits, we increase or diminish, at the same time, both the temperature and the quantity of aerated water.

It was ascertained, previously to the time of Dr. Edwards, that if a fish be placed in a small given quantity of aerated water, the water absorbs the air in contact with its surface, a fact from which this inference is readily deduced that the life of an animal in a limited quantity of water will be protracted the longer, the more copiously the water absorbs air to compensate for what it supplies to the animal. Now, Dr.

preserves always a certain proportion of azote, which it employs perhaps, partly to fill the natatory bladder.

There are also fishes which swallow atmospheric air, and convert

Edwards, considering the bearings of this phenomenon, actually took a large mouthed vessel into which he put five ounces and half of aerated water; he brought the water to the temperature of 68 deg. Fahr. Into this vessel he put a little fish called the bleak (*cyprinus alburnus*) and in a few minutes the animal died. He then tried another fish in the same vessel, and with the same quantity of water, but with a decrease of its temperature, amounting to ten degrees only, when the animal continued to live until its secretions became so abundant that they actually corrupted the water. Here, then, we have the important principle determined that the more the temperature is raised beyond certain limits, the greater is the degree of influence of the air required for the support of life.

But of all the experiments to which fishes have been subjected, that is by far the most intensely interesting which is carried on by exposing them merely to the action of the atmosphere.

The fishes themselves, indeed, have suggested this modification of man's experiments, because, when, in a given quantity of water which has been aerated, a fish has reduced the combined portion of air contained in it until its respiration becomes very difficult, then the creature rises to the surface and actually takes it from the air itself, and so essential is this operation to them, that, as Sylvestre has proved by experiment, the fish cannot live in a small quantity of water if we exclude the atmospheric air from its surface. This naturalist placed a diaphragm on a vessel in which a fish had been previously put, and he found that the result was a speedier termination to the life of this animal than befell another animal of the same kind in another vessel which was freely exposed to the atmosphere. Hence, then, we have a most undeniable proof that the structure of the gills of fishes was endowed with a double faculty of extracting oxygen from water, and also from air, two fluids so differing in their chemical constituents.

The existence of fishes in the atmosphere is one of the most mysterious facts in comparative anatomy. If we take a fish out of water it dies, some in a few minutes, and others in a few hours, and hence the conclusion was universally received that fishes died in the atmosphere because the state of the air in it was too thick as compared with its condition when dissolved in water. Now it is likewise true that nearly all the vertebrated classes of animals perish from the very contrary cause, namely, the transition from the atmosphere into aerated water, so that whilst the latter die in water because they have too little air, fishes die in the atmosphere because they have too much.

The most marked effect derived from the exposure of fishes to the atmosphere, is the loss by perspiration. Dr. Edwards took out of water a chub and a gudgeon, and wiping them and then weighing them, he exposed them to the air. Their gills continued to move till death, but their bodies were observed to get gradually dry, and when they died they were stiff and dry as chips. He then weighed them, and found that the first had lost nearly one-fourteenth of its weight, the other one-fifteenth. This naturalist having, in his researches on the reptiles, found a great many interesting results produced by the loss of perspiration from exposure to air, and resolved upon ascertaining if the same consequences could be obtained in the fishes. We extract his account of the effects, from the very excellent translation of Dr. Edwards' work by Doctors Hodgkin and Fisher.

“To simplify the examination of this subject, let us here consider, as we have done in our researches on the batrachians, the losses by perspiration, as solely at the expense of the water contained in the animal. Capacity of saturation with water implies the quantity of this liquid which an animal is able to contain, between the point of greatest repletion, or saturation, and that of the greatest inanition, compared with the weight of its body. The means of carrying the body to the point of saturation when it is capable of absorbing water, is to place it in that fluid, until the increase in weight has arrived at its maximum. This is exactly the con-

the oxygen into carbonic acid, in making it pass through their intestines. Such is the cobites, according to the curious experiments of

dition in which fishes are found in their natural state, and on removing them from the water in which they live, we may regard them as saturated with this liquid, provided they are in a state to absorb it. Now we shall take the measure of their capacity of saturation with water, as we have hitherto done in regard to the batrachians, the loss which they experience by perspiration before death; and we see it is sufficient to ensure the death of fishes, that they lose the fourteenth or fifteenth part of their weight. If this loss appear too inconsiderable for us to ascribe the death of these animals to it, let us compare this result with those which we obtained in our researches on the batrachians. They were not given in the preceding chapter, that they might be reserved for this occasion. It has been shewn that the point of saturation with water, in the case of the batrachians, depends on the state of their nutrition, and that it may vary within very considerable limits. Now, the losses which they undergo by perspiration vary in the same manner. In conditions favourable to nutrition, their capacity of saturation may equal the third of their weight; but, in unfavourable conditions, it is so small, that the least appreciable loss is sufficient to cause death. On applying these results to fishes, whose capacity for water is small compared to that of batrachians, we shall see that the loss which they experience by evaporation is enough to cause their death in air. But the phenomena relative to this subject are not always so simple; they may be very complicated: one might be led to believe, that atmospheric respiration would keep fishes alive, if we could devise means for obviating their loss of weight by evaporation. With this view, a fish which had been wiped and then weighed, was suspended in a limited quantity of aerated water, so that it had its head and gills above the surface; it died in nine hours and twenty-one minutes. On then weighing it again, it appears that it had not sensibly diminished in weight, but on the contrary, had slightly increased. This result would appear to be independent of the cause we have before assigned for the death of fishes, where the whole body is exposed to the action of the atmosphere. But before enquiring into the influence of a new cause which may be added to the first, let us more attentively examine the complicated case in which fishes are found in the circumstances of the experiment last related. The body is plunged in water, but the head and gills are exposed. On one hand absorption takes place in the water, on the other, perspiration in the air. The absorption by the body plunged in water is proved by the slight increase of weight which takes place during the experiment, and the loss by perspiration from the part exposed to the air is demonstrated by the preceding experiments. Now it is evident, that the organ of respiration, which is exposed to the atmosphere, cannot continue its functions unless the losses by perspiration are repaired. It is true, the rest of the body absorbs, and that on the whole, it does not lose any of its weight; but this condition is not sufficient for the continuance of respiration. It is also necessary that the distribution of the fluid absorbed by the trunk, should be such, that the gills and muscles which move them should receive a proportion of it, capable of repairing the loss which those organs experience by perspiration. Presuming it possible that this equilibrium might not take place, I made the following experiment to enquire into the relations of partial and simultaneous perspiration and absorption. I placed some fishes in the opposite position to that of the fish employed in the last experiment, that is, with the head and gills in water of the same quality and quantity, and the trunk, suspended in the air by a thread passed through the end of the tail. They lived in this state many days. I weighed them after that interval, and discovered that there was evidently, in this case, a slight increase of weight. But the drying of the surface of the part of the trunk exposed to the air, was as marked as in the case where these animals were entirely exposed to the atmosphere, and where they died after a considerable diminution in weight. It is therefore evident, that the fluid absorbed by the gills was not distributed to the rest of the body in a proportion sufficient to repair, in all parts of the trunk, the loss which it had sustained by perspiration in air.

“The following fact, relative to the physical conditions of fishes in air, is important in the consideration of the principal causes of their death when so placed.

M. Ehrmann, and even in all there is a similar transmutation on their skin or under their scales.

When fishes remain out of the water they perish, not on account of the want of oxygen, but because their gills become dry*, and the blood cannot circulate there easily: also the species in which the branchial orifice is narrow, as the eel, or those which possess some receptacle in which they preserve water, as the anabas and the ophicephalus, subsist for a longer time in the air, whilst those in which the gills are very cleft, as the herring, expire the instant they are taken from the water.

Particular Excretions and Secretions.

The excretions of fishes, as those of the other animals, are performed either by the skin, or by special secretory organs.

The kidneys are more voluminous in them than in any other class, and extend on both sides of the spine along the abdominal cavity, often ascending as far as under the base of the cranium and above the gills and the heart: they are often united to each other by their posterior part, and even, in almost all the acanthopterygians, they unite at their anterior part above the œsophagus. In the perch this

Some fishes, when exposed to the air, soon cease to move their gills, although they continue to live pretty long afterwards; but they die much sooner than those of the same species whose gills beat to the last. Suspecting that this difference in the duration of life proceeded from the interception of the air, I remedied it by raising the gills by a small peg placed beneath them. The branchiæ were thus exposed to the air. This change of condition, in relation to the atmosphere, proved sufficient to protract life as long as in those cases in which the respiratory movements were continued spontaneously. The effect of thus raising the gills is so considerable, that if the gills of a fish, out of water, have quickly ceased to beat, we may, by its means, restore for a while, their spontaneous action, and even do so for several times in succession. We see, therefore, that the life of fishes in the atmosphere, depends on several conditions; of which the principal are, temperature, the capacity of saturation with water, the corresponding loss by perspiration from the trunk and gills, the quickness of this loss, the action of the muscles which moves the gills, and the use which they make of their muscles to avail themselves of the action of the air upon the gills. In short, they come under the general law, relative to the influence of the atmosphere on the life of vertebrated animals. As fishes seem to form an exception to this law, I have thought it necessary to shew that they are so only in appearance. What has been here stated relative to the life of fishes in the atmosphere, is equally applicable to tadpoles, placed in the same circumstances. They die from the quantity of water which they lose by perspiration, and although their capacity of saturation is, at least, equal to that of frogs, since it varies between one-third and one-fourth of their weight, yet, as their size is very small, and their perspiration rapid, on account of the delicacy of their skin, they soon lose that proportion of water, and in the experiments which I made, I found that they did not live more than four hours."

We shall conclude our account of fishes by mentioning that in their case too, as well as in all others connected with the animal and vegetable kingdoms, there is evidence that they are subject to the same general laws as nature has imposed on every member of her vast dominions, namely, that there are many instances of exception to this incapability of enduring high temperatures. It is proved that some fishes actually live exclusively in hot springs which are literally three times higher in temperature than the water by which Dr. Edwards killed fishes in a few minutes.—ENG. ED.

* See Edwards, *Influences des agens physiques sur la vie.*

anterior part is very voluminous. In the cyprins the kidneys are enlarged, particularly opposite the constriction of the natatory bladder. The ureters, more or less long, according to their genera, end in a dilatation, which supplies the place of a bladder, and whose external orifice is placed immediately behind the anus and the orifice of the organs of generation, which themselves open, sometimes within, sometimes on the border even of the anus, but always at its posterior part, which is the inverse of what is seen in quadrupeds. Sometimes, as in the chondropterygians, the orifices of the ureters and those of the vasa deferentia give a cloacum which is either common or at least in the same opening.

The skin of fishes is moistened by various humours prepared by appropriate vessels opening externally at different points according to the varieties of the genera. This generally is a mucus which it is exceedingly difficult to dilute with water.

In the ray there is at first, on the inferior surface, a large vessel which surrounds the snout, forming there angles and very regular circular lines, and which pours its liquor on either side by three or four branches, reflecting itself upwards to terminate in a great number of little apertures, and we see further on each side, at the external angle of the branchiæ, a sort of round and white bursa, into which a considerable branch of the fifth pair of nerves penetrates, and from which a multitude of long and simple vessels, proceeding in radiating bundles in four or five directions, ultimately disembogue themselves at various points of the skin, each being situated very remotely from each other*.

Almost all the thickness of the snout of the squalus is occupied by a cellular tissue filled with mucilage, whence proceed the bundles of tubes which secrete this mucilage by the pores of the skin, and we there see further, large regular vessels, of which one runs all the length of each side of the body.

In the cod, there is a large vessel which runs along the whole length of the body, bifurcates behind the eye, proceeds by two branches on each side towards the end of the snout, and gives, at intervals, branches which open into the skin: a smaller one creeps along the preoperculum and the inferior gill.

The eel and conger have large openings at different points of their snouts, through which those long vessels open that are analogous to the vessels forming in the rays, such regular circular lines; but each species will offer in this respect differences which it will be requisite to enumerate in its proper article, and we shall content ourselves here with these indications.

The lateral line of fishes has generally some secretory apparatus which follows its length; this is seen, in particular, very distinctly in the tunny, in which a body of a much deeper red than the rest of the flesh, passes every where beneath the lateral line; this gives off small tubes constituting the pores of the line; each of these small tubes receives a filament of nerve, from the lateral line, there is something very much like it in the carp.

* Munro, pl. V.

The cellular tissue placed under the skin, is more or less filled with an oily grease; it is abundant in the genera of salmons, and in some other fishes noted for being fat; but this is not the greatest number. In some, as the moon-fish, there is a thick layer of a kind of bacon; but gelatinous and not oily.

An oily grease fills also, very generally, the interval between the muscles, and we have seen that it is almost always round the brain.

Some fishes, nevertheless, want this grease; the cod, the pluronectes, and, in general, the cartilaginous fishes have it not even in the cranium; the sturgeon on the contrary, has this grease, which surrounds the brain very abundant and very compact.

One of the most remarkable secretions which take place in the body of fishes, is that of the air which fills their natatory bladder; at least it is pretty certain that, in the very numerous genera in which this bladder has no external communication, the air, which it contains, can only be produced by a secretion, for which purpose there is an addition in these genera of very diversified glandular organs*. There also exist fishes, such as the eel, which combine a canal of communication with the glandular organs; but in the greatest part of those which have this canal, we do not see the glands.

The bladder itself is composed of a tunic, extremely fine internally, and of another tunic which is thicker; it is also of a very peculiar fibrous nature, and which yields the best isinglass; it is lined externally by the general tunic, which the peritonium affords to all the intestines. It is sometimes simple, as in the perch; sometimes furnished, as in certain cod, with appendices more or less numerous, and sometimes branched, as in certain scienas; sometimes it is divided into two parts, one anterior and the other posterior, by a strangulation, as in the cyprins, the myripristis, the therapons, and many of the salmons, or into two lateral parts by an emargination, as in the tetrodons and the diodons. The catestomes have it divided into three parts. It is principally in the abdominal fishes that it communicates by a pipe with the intestinal canal, either with the œsophagus as in the cyprins, or with the bottom of the stomach as in the herrings. That of the sturgeon is immediately directed into the œsophagus by a large opening. It is sometimes furnished with muscles proper to itself, especially in the sciœna, and in several salmons of the division of charax, (the sargus of the author.)

It is generally azote, mixed with some fractional parts of oxygen or carbonic acid, which is found in the natatory bladder†.

Nevertheless, M. Configliacchi asserts that he has found there as much as forty centimes of oxygen; M. Biot has remarked that those fishes which are accustomed to live in deep water, have this gas in a

* Gauthier Needham, in his treatise *De formato facto*, is the first who gave particular attention to this organ, and who established the fact that the air is introduced into it by secretion. Redi in his *Observations on Animals that feed on living animals*, has settled the precise bodies which are employed in several fishes for this secretion. Kalrœuter has also given proofs of this origin in his memoir on the late, Nov. Comm. petrop., vol. xix. My Memoir on the Maigre as respects the same subject is in the *Mem du Mus.*, vol. I., p. i.

† This observation is dull: originally to Fourcroy.

greater quantity, and he once found it to amount to eighty-seven centimes*.

The most obvious use of the natatory bladder is to keep the fish in equilibrium with the water, or to render it heavier or lighter than that fluid, and to allow it to descend or rise, according as it compresses or dilates this organ. To accomplish this, it is only necessary for the fish to approximate to, or separate the sides from, each other. It is certain that fishes, in which it has been burst, remain at the bottom of the water, and are turned upside down, no longer enjoying the facility of motion which they exercised before.

A curious phenomenon occurs when fishes are caught by the line, and which are fished up from a great depth with such expedition, that they have not time to compress their bladder, or to empty it of the air it contains; this air, being no longer compressed by the large column of water which pressed upon it, bursts the bladder and diffuses itself in the abdomen; it dilates it to a great extent, and pushes the œsophagus and stomach into the mouth.†

It has been thought ‡ that the natatory bladder may be also an auxiliary to the organs of respiration; it is certain that when a fish is deprived of it, the production of carbonic acid by its gills is almost reduced to nothing§.

But, as to what has been said respecting its being essentially the analogue of the lungs, because in certain species it communicates with the œsophagus, and because it is not more destitute of cells and vessels than the lungs of salamanders, for example, we must declare that this does not appear to us to rest upon any real foundation.

Not only is there no resemblance in the distribution of vessels; not only has the natatory bladder of an infinite number of fishes—of indeed by far the greatest number without any comparison—no direct external communication; but in many it is at the bottom of the stomach, that the canal by which it is made, opens, and, in fine, in the species even in which this communication takes place by the œsophagus, it is not in the same relative connexion; but is above that the natatory bladder opens into the canal, whilst the lung always communicates with it below (*a*).

* See on the air contained in the swimming bladder, the Memoire of M. Bict, in the first volume of la Société d'Arcueil, p. 252, 1807; part of this of M. M. Provençal and of Humboldt, on the respiration of fishes, same work, vol. II, p. 359, 1809; and the work entitled: Sull' analisi dell' aria contenuta nella vescica natatoria dei pesci; memoria di Pietro Configliacchi; Pavie: 1809, in 4to.

† This was observed in the Mediterranean by M. M. Bict and De Laroche.

‡ M. Gotthelf de Fischer, on the natatory bladder of fishes. Leipsic, 1795.

§ This is the result of the experiment by M. M. de Humboldt and Provençal, *loc. cit.*

(*a*) Upon this singular organ much light has been thrown in modern times; the principal facts connected with it have been recently collected by Dr. Tiedmann, professor of Anatomy and Physiology at the University of Heidelberg, and to him we are indebted for the following summary.

The impression of most naturalists is that the greater part of the fishes possess, independently of their gills, another organ analogous to the lungs, which is the natatory or swimming bladder. This organ is situated in the abdominal cavity, along the inferior surface of the vertebral column, and it generally communicates with

As for the rest, whatever opinion may be formed respecting its uses, it is difficult to explain how an organ so considerable has been denied to so great a number of fishes, and not only to those which generally remain quiet at the bottom of the water, as the rays and

the pharynx or the stomach by means of a membranous canal. Many blood vessels, as well as the branches of the pneumogastric and great sympathetic (1) nerves are distributed through its sides. The air it contains is composed, according to the researches of Priestley (2), Fourcroy (3), Brodbelt (4), Bict (5), Erman (6), Confiagliachi (7), Provengal and Humboldt (8), Geoffroy (9), and Delaroche (10), of the same elements as the air, that is, of oxygen, azote, and carbonic acid; but their proportions are subject to great variation. Erman has found, in fresh water, fishes less of oxygen than there is in atmospheric air, whilst, according to Bict, the proportion of this same gas is more considerable in sea-fish, especially those which keep at a great depth. Lacépède (1) pretended that he has also found in it hydrogen, but no other naturalist agrees with him on this assertion.

Very probably the natatory bladder performs the part of an accessory organ in respiration, as Fischer (2), Nitzoch (3), G. R. Treviranus (4), and many others have admitted. The fishes which are remarkable for their very quick and prolonged movements, appear to be principally those whose respiration is carried on by the assistance of this organ. They appear to accumulate the respirable air in those circumstances in which they take in more than they can consume, and employ this reserve in other circumstances in which they have need of a greater quantity of air. And what seems to favour this hypothesis, is that flying fish, such as the mullets, and according to the researches of Humboldt, the flying fish are furnished with very ample natatory bladders. Delaroche has also seen this organ very large in the flying scorpena, whilst those species of the same genera which do not fly (scorpena, porcus, scrofa, dactyloptera, &c.); are generally without it. A voluminous natatory bladder is likewise found in the salmon, the sword-fishes, the pike, the herring, &c., which are distinguished for the rapidity of their progress, whilst it is not so in those fishes accustomed to remain at the bottom of the waters or in the mud, and whose movements are slow, as the rays, the lampreys, many blennies, the remora, the bull heads, &c.

It is still doubtful whether this bladder ought to be considered as acting simultaneously as an organ vicarious to the process of natation, and allowing, by its distention or contraction, the fishes to raise or to sink themselves into the water, as is the opinion of Borelli. As many fishes deprived of it are nevertheless good swimmers, as in others it does not always communicate with the pharynx and stomach by means of a canal which allows the air to pass out of it; and in fine, as it is sometimes, as in the loche cobites fossilis, for example, enclosed in an osseous capsule, which consequently does not allow it to dilate or shrink: this opinion does not appear very plausible. It may again be alleged that fishes in which the natatory bladders has been burst, still retain the faculty of rising and descending in the water, as the experiments of Humboldt and Provengal have incontestably proved.

Many fish breathe also by the intestinal canal, by means of the air which they swallow. This fact Erman has demonstrated in his beautiful experiments on the cobites fossilis. The air escapes at the anus in the state of carbonic acid gas. The electric eel rises also to the surface of the water, according to the observations of Humboldt, in order to take in the air.

Sylvester has also shown that fishes which thrust themselves into the mud occasionally, rise to the surface of the water for the purpose of obtaining the air mixed with it, the air which they had in the water below being wholly consumed by respiration.

The results of the experiments by Dr. Edwards, of Paris, prove that the necessity of respiration is increased in fishes by increase of temperature, so that during summer very many fishes are obliged to draw in air by the mouth.

Such are the facts recorded by this author, and it only remains for us to refer the reader to the very curious and interesting experiments of Dr. Edwards, to which M. Tiedmann has just alluded, and of which an account will be found in the preceding Section on Respiration.—ENG. ED.

pleuronectes, but to many others which appear to yield to none in the rapidity and facility of their movements, as the mackarel, for example. The presence or absence of the natatory bladder is not even consistent with the other relations of conformation of fishes, and even in the mackarel genus, a species very similar to the common mackarel, (the scomb. *pneumatophorus* of Laroche.), is found provided with it*. There are many similar examples; the *polynemus paradisæus* wants it, whilst all the rest of the genus are provided with it; it is very large in the *sebastes*, and in a neighbouring genus, the *pelores* (*m*), it is scarcely the size of a pea.

The power with which a small number of fishes is endowed of producing electric shocks, may also be ranked amongst their greatest singularities of organization, so much the more as the organs by which they exercise this power do not differ less between themselves than they differ from organs of other kinds.

In the torpedo, there are membranous tubes filled with mucus, and divided by transverse septa, which are closely compacted together, like the radii of bees, in two groups placed on each side of the head, and which receive enormous branches from the fifth and eighth pairs of nerves†. In the gymnotus, we find this apparatus occupying the whole under part of its body to an immense thickness, formed by parallel laminae, which are separated by very delicate layers of mucilage‡.

In the silures, two layers, of different substances, are interposed between the skin and muscles throughout the greater part of the body. The external one is cellular, and its external surface aponeurotic; it receives the nerves of the fifth pair. The internal layer is of a flocculent tissue; and derives its nerves from the intercostals§.

* See the Memoire of M. de Laroche, upon the anatomy of the natatory bladder of fishes, and my report upon this Memoire, in the *Annales du Museum*, t. XVI.

† The benumbing power of the torpedo was well known to the ancients, and both Ossian and Claudian have celebrated it in song. Among the moderns, Borelli and Redi have been occupied with it. Lorenzini, in 1678, in a special work *Observationi intorno alle torpidini*; Kœmpfer, in 1712, *Amon. exot.*, p. 509; Reaumur, in 1714, *Mem. de l'Acad. des Sciences*, p. 344, have described this singular action, and the organs which were the seat of it. The latter were dissected and examined more in detail by J. Hunter, *Phil. Trans.* 1773, vol. 63. The electric nature of the shock was determined by Walsh's experiments in 1772, at the island of Ré, and Rochelle, and his account reported in the same volume of the *Transactions*, as also in vol. IV of the *Journ. de Physics*. The organs have likewise been described by M. Geoffroy, *Ann. du Mus.* vol. 1; but he has very unwittingly believed them to be representatives of the mucous vessels of the rays. The latter vessels are found in the torpedo quite independently of the electric organs.

‡ The electric power of the gymnotus, has been discovered by Richter, *Mem. de l'Acad.*, 1677; and described by Lacondamene, Brankroft, and Fermin. Its nature has been recognized since 1757, by Sgravesand, Governor of Essequibo, according to what Allamand points out. In 1755, Walsh completed the demonstration by obtaining sparks. The organ has been described by J. Hunter, in vol. 65 of the *Philos. Trans.*

§ It was Adanson who made known, in 1751, the benumbing power of the Silurus, and described it as resembling, in its effects, those of the heydon jar; this is the first example discovered of the analogy subsisting between this sort of phenomenon and electricity. The electric organ of the silurus, has been described by M. Geoffroy, *Ann. du Mus.* vol. 1, p. 3, pl. 26, f. 4; and with more exactness by M. Rudolphi, *Mem. de l'Acad. of Berlin*, 1824, p. 137, et seq. and pl. 1 to 4.

By means of these apparatuses, it has been thought that in consequence of the different lamina being placed alternately with respect to each other, there was generated something like a galvanic pile, and that these animals could, at will, communicate to those who touched or went near them, a true electric shock. This power is exhausted by use, and the fish requires repose to be able to renew it. For those fishes which have this endowment it is an efficient defensive weapon, and it probably serves them also as an instrument for stunning, if not for killing, the animals on which they prey*.

CHAPTER VIII.

Organs of Generation of Fishes.

THE rays, squalus, and chimœras, which produce eggs of considerable size, and frequently surrounded by very strong, horny shells, or which bring forth live young, possess organs very much resembling those of reptiles, for the production of the egg, and for its fecundation in the interior, as well as for the time, long or short, during which the egg or the fœtus remains within the body of the mother.

In other fishes, however, even in those which bring forth their offspring alive, and which must be fecundated before they spawn, the organs for the two sexes are found to be extremely simple; that is to say, in the female, two membranous bags, the walls of which, being more or less multiplied by folds, contain in their thickness the eggs, until the time arrives, when these eggs have obtained their necessary development, and it is by rupturing the membrane which retains them that they escape; now, in the male, the two sacs hold in reserve, an abundance of fecundating fluid, which has been secreted by the glandular tissue of its walls.

The ovaries of the ordinary fishes are variable both in their size and in the number of lobes into which they may be divided. Sometimes one of them is completely obliterated, so that only a single lobe is developed, and this is exemplified in the perch; most commonly, however, there are two, whose form is oblong or oval, and whose internal lamina forms a larger or smaller fold, according as it may be necessary for the eggs contained in it.

In the lophius there are two enormous bags with very thin walls, which only carry the eggs in the thickness of one of their sides. But these eggs, are very numerous in those sacs, and except at the period when they are laid, the small groups which they form, appear to the naked eye, just like so many little papillary eminences, such as we find in the intestines.

The viviparous osseous fishes, as the blennies, silures, anableps, &c. differ in no respect whatever, as to the structure of their ovaries, there being, in each, two bags formed by two tunics, in an intervening space between which the eggs arise. In the progress of their enlargement, the eggs protrude, and produce a swelling of the internal tunic, which then moulds itself as it were upon them so that

* The experiments of Williamson especially prove this, see vol. 65 of Transactions.

they are merely held in the ovaries by a pedicle. It is in this situation that they increase in size, and the germ, contained in them, is developed, as that of an oviparous fish, is developed in water.

The two ovarian sacs generally unite in a common canal, which has its outlet behind the anus, and before the urinary orifice. It is the same with those of the testicles.

Very frequently this outlet is only a simple hole, but has a protruding portion in the form of a slip, which then exists in both sexes, and always that it may be subservient to their congress; for it is observed especially in the genera which have many viviparous species, as the blennies, gobies, &c.

In certain fishes, as the eel and the lampreys, the ovaries divide externally into a great number of lobes of different figures, kept together by a common membrane, and containing eggs in their folds: these are not sacs, but resemble heaps of piled leaflets.

They are without a canal, and the eggs can only escape by falling into the abdomen, and leaving it by one of the two holes pierced on the sides of the anus. This is what is known to exist, particularly in the lampreys*, and what we are also obliged to believe of the eel.

It has equally been advanced of the trouts†, of which it is true, that the ovaries are closed, on the side of the abdominal cavity, by the peritoneum, that glues them to the region of the spine, and as they are internally divided into transverse laminae, without there being seen any outlet for the eggs, that which is taken for the oviduct, apparently reduced to a simple ligament.

The number of eggs, in the fertile species, is sometimes frightful; in more species than one, it exceeds a hundred thousand.

Now and then we find amongst the ordinary fishes, individuals which have, on one side an ovary, and on the other a testicle, and which are consequently true hermaphrodites; but it appears that certain species naturally and constantly unite the organs of both sexes. Cavolina asserts this of the acanthopterygians, the sea perch; and Sir Everard Home, the eel and lampreys; with regard to the last, M. M. Magendie and Desmoulins, think that the males are infinitely less numerous than the females ‡; but the solitary example which they produced may be only a female void of eggs, or whose eggs by some cause, were not developed. As to the sea-perch we have ascertained that the posterior portion of their ovaries, is of a very different tissue from the rest of their mass, and very like that of a milt. It remains to be proved, whether this part really performs its functions.

The rays, the squalus, and the chimera have their organ, more complicated. The testicles of the ray, placed at the top of the abdomen upon the stomach, (or behind it, supposing the fish to be erect

* Carus *Lootomie*, p. 637.

† Dumeril, upon *Cyclestome* fishes, p. 53.

‡ These anatomists have observed a lamprey, which, although it was caught at the time when all the others were full of eggs, had, it is true, organs placed and divided like ovaries, but whose leaflets contained no eggs, and only appeared to offer a very fine tissue; but by means of the microscope, globes similar to those which contained the ovaries of the sturgeon in their faded state were perceived.

upon its tail,) are composed of lobes, but are harder and more rounded, being divided into very small lobules, and of a part softer and more like the milt of other fishes; in the squalus, the testicles are bulky cylinders, bent as they wind, and divided at the inferior surface into an infinite number of vessels: from the top of these bodies proceed two epididymes, each composed of the infinite folds of one single vas differens, which enlarges and is less twisted as it proceeds towards the anus; after being puffed into a kind of seminal vesicle, it opens, with that of the other side, into a conical prominence of the superior surface of the rectum near the anus, which may pass for a penis, or at least serve for the same use during congress.

The females of these same fishes have two ovaries, in which the yolks of their eggs grow as in those of fowls; when they escape they are seized by the two oviducts opening immediately above the liver, and very near the diaphragm. These oviducts are membranous and thin as far near as the middle of their length, where each passes through a large kidney-shaped gland, formed of a peculiar tissue, and which would seem to pour by means of thousands of pores into the interior of the oviducts the substance proper for producing the shell; after having passed it, these canals descend and open at each of the sides of a purse, situated behind or rather above the rectum, and which forms a true womb: this purse is opened by a large orifice at the extremity of the rectum, at its superior wall.

When the rays and squalus wish to fecundate themselves, they bring their bellies to each other, and the males have at their ventral fins appendages often very complicated in their structure, and which appear to enable them to seize with more power the tail of their females.

The male sturgeon has its testicles suspended to the mesentery, and is without a vas differens, but a tube rather large opens into the abdomen, and receives there the semen, runs obliquely there towards the base of the urethra, into which it terminates and empties itself, as well as the urine, at an opening pierced behind the anus.

The eggs of the rays are covered with a shell of a fibrous tissue, resembling horn, enveloped externally and doubled internally by a thick and glutinous membrane; its form is flattened, square, with four angles prolonged into points. These eggs are commonly called sea-bass or sea-mice*; they contain besides a yolk, an albuminous and transparent mass. The egg of the squalus is oblong, of homogeneous horn, often yellow and transparent: sometimes its surface is elevated by transverse projecting laminae; its angles are prolonged into long, folded, and horny cords.

It appears that this shell is formed when the egg passes the gland which occupies the middle of the oviduct; it is formed by secretion and by layers. When the egg is seized in the oviduct, it is sometimes found still attached by its posterior part in the passage of the gland, and this part is then soft and incomplete. I have reason to think that the points of the egg in the rays and the cords of those of the squalus, are drawn into the lateral furrows of that part of the oviduct

* See Tilesius, on the eggs of horned fishes, and on the reproduction of the rays and squalus (in German; Leipsic, 1804, in 4to.)

which passes through the gland. The egg of the chimœras is also enveloped in a strong shell which is flat, horny, oval, and velvety.

To all these shells of the chondropterygians, which are of a horny nature, and not being liable to break like those of the eggs of birds, nature has given an opening at one of their ends, from which the young may remove the edges and get out when it has acquired a sufficient development; it has even been thought that when the eggs are layed, this opening allows the water to aid in the respiration of the foetus; but I have always found it closed by a membrane*.

In the viviparous squalus, whose young is hatched in an oviduct or in the womb, such as the sharks, there is only a membranous envelope round the foetus, in which is always recognized the tortuous cords of the eggs of other species.

Certain species carry their eggs upon them during some time after having layed them, and even some until they are hatched. Thus the syngathnes have, behind the anus under the tail, a hole shut by two scaly pieces, as by two lids, in which the eggs are deposited *seriatim*, and where they remain until the young are hatched†. The aspredes carry them suspended to the skin of their belly.

But the greatest number of fishes scatter their eggs in the water, agglutinated by a mucilage which enveloped them and attaches them to stones, or aquatic plants, sometimes in groups, sometimes in strings or in net-work according to their species. These eggs are transparent globules, in the middle of which is seen the yolk. In this state the male fecundates them by distributing the milt, and it is in this distribution or fecundation of their eggs, that the fishes exhibit the greatest activity: it is then that many come up the rivers, that others travel in troops, and that others follow or pursue each other, either in pairs, or in a much greater number.

The germ shows itself with more or less rapidity in the fecundated egg, according as both the temperature, and the growth in general are tardy: the young generally comes out before it is very large, by piercing the envelope with its tail‡.

In viviparous osseous fishes, such as the silures, the anableps, certain blennies, &c., the egg grows even in the ovary, as much as is necessary for the foetus, which is there developed; and there are species in which it becomes remarkably large. The young having been completely hatched, breaks the egg and the membrane which had retained it.

All these eggs are composed, besides the foetus, of a vitellus which communicates by a pedicle with the intestine of the foetus, and which diminishes, in proportion as the foetus grows, and of an external membrane, which corresponds to the membrane of the egg-shell of birds, and which contains the foetus and its vitellus.

I have not hitherto detected an amnios, at least unless we regard as

* See Home, Lessons of Comparative Anatomy, Lesson Thirtieth.

† It is this improper view which made Aristotle say (Hist. An., t. vi. p. 15), that the eel (le syngnathe) is ruptured when the time of laying approaches, and that it has under the belly a cleft which closes after laying, &c.

‡ On the fecundity of the eggs of fishes, see Carolini's Treatise of the Generation of Fishes and Crabs (in Italian, Naples, 1787, and 1784, in 4to.; in German, Berlin, 1792, in 8vo.)

such the internal tunic of the general membrane; but this amnios embraces the vitellus as well as the foetus.

The vitellus has two tunics, both complete, and very fine. The external is continued by its external lamina with the skin, and by its interior with the peritoneum; the internal, very vascular, is continued with the membranes of the intestines and their peritoneal tunic; the cavity opens directly and visibly into that of the intestines, and the yolk matter there flows. There are some genera, as the squalus, in which I have seen a lobe of interior vitellus always enclosed in the abdomen of the foetus; it is the same as an appendix of the intestine. The arteries of this internal tunic come from the coeliac artery; its veins terminate at the vena portæ.

What distinguishes essentially the eggs of fishes, as well as those of the batrachians from the eggs of animals which, once hatched, respire always by the lungs, is the entire absence of the allantois and the umbilical vessels, which do not appear to show themselves at any period. There is, consequently, no placenta, and which are the vitellus, which is always very much reduced in those foetuses of the shark ready to be born, appears to me to adhere to the womb almost as fixedly as to a placenta. Its cord is bristled with a quantity of vascular ramifications, or of a species of long hair, very similar to that of the roots of trees.

Most frequently the abdomen is not swelled even by that interior lobe of which we have just spoken; but sometimes, as in the anableps, the vitellus has already disappeared to a considerable extent externally, whilst the abdomen has still a swelling formed by a dilatation of the skin of the fish, and in the interior of which may be seen, with the intestines, the remnant of the pedicle of the vitellus. This swelling, which already shows small scales scattered up and down upon it, contract by degrees, and then the scales approach each other.

In whatever manner the fish has been brought into external life, it is, from that moment committed to itself, and with the sole responsibility of providing for its wants. The greatest number of them perish, devoured by larger fishes, aquatic birds, or reptiles; those which survive, assume a growth more or less rapid according to their species: in certain fishes this growth continues almost the whole of their lives, and the life of some is very long. It is pretended that that of the carp has been known to be more than a century; but this long life, which is attributed to the slight hardness of the bones, is far from being granted to all the species.

CHAPTER IX.

General Recapitulation of the Organization of Fishes.

SUCH is the general idea, according to our view, of the nature and organization of fishes, an idea which will not be complete until we add a particular description of each of the species, in stating every thing that is peculiar to each.

The general result then, according to us, from the whole of these observations on their peculiar organizations, is, that fishes constitute

a class of animals distinct from all others, and exclusively destined by their conformation to live, move, and perform the acts which are essential to its nature in the atery element. This is their place in the creation; here are they to reside from their origin; here they are to remain until the destruction of the present order of things; nor is it by empty metaphysical speculations, or by very superficial approximations, that we are to estimate their class as a development, a perfect state, an ennobling, as it were, of that of the mollusca, or as a rude first draught, or the foetal condition of vertebrated classes.

There is no doubt that the mollusca breathe as fishes do, by gills; have, in common with the latter, as with every other class of vertebrated animals, a nervous system, a circulation, an intestinal canal, and a liver; and no one is better acquainted with this than myself, who was the first to make known their anatomy, and their zoological relations.

As animal life has received only a definite number of organs, it must follow, as a matter of necessity, that some at least of these organs should be common to many classes. But where else is there any other resemblance? Is the frame-work of these animals, is their entire system of locomotion to be compared to the others in the smallest of their parts? And how could the organs even which are now common to the mollusca and fishes be brought into the relations and connexions which they have in the latter and in other vertebrated animals? By what process of transition could nature have brought us from the one to the other? It is very easy, I am aware, by entirely forgetting all their differences, to get up a definition which would comprehend only what they have in common; but this definition would always remain a mere abstraction of the mind, a definition purely nominal, a vain combination of words which could never be represented by any common system, however divested of details we should try to conceive it to be.

The same method is adopted to bring everything together, as may be wished for, ultimately, as any two beings, however remote from each other they might be, would always resemble each other in some point, were it only by their existence.

The heart even in the mollusca, which have only one, is placed in a direction contrary to that of fishes, and is attached to the junction of the branchial veins and arteries. In many of them the limbs are in the head; in others the organs of generation are on the side; frequently those of respiration are above those of digestion, or disappear completely over every portion of the dorsal surface. In a word, they have branchiæ; so have the fishes, but there is the whole of the affinity between them.

Hence it is observed, that as often as people wish to sally forth with these formulæ, which are purely verbal or metaphysical, they necessarily wander into comparisons which have not the least possible title to be admitted.

For one of these gentlemen the shells of bivalves represent the opercula of fishes: for another the shield of the cuttle fish is a true fibrous bone: a third will have it that the scales of the sturgeon, or the spines of the diodons, would ultimately become an external skeleton. Some others are disposed to seek analogies for them in the crustacea;

the border of their thorax represent the opercula, and underneath these borders virtual branchiæ are found. But let us only go a little further and every thing is reversed; the medullary cord is towards the belly, the heart towards the back, and this heart, like that of the mollusca, receives blood from the branchiæ instead of sending it to them. Thus, in desperation for the cause, do some show an anxiety to find the rays or spinous apophyses of the vertebræ in the feet of the crustacea; but then this would be so far from an improvement towards perfection, that it would be an obvious degeneration.

The approximation of fishes to the other vertebrated animals, is not altogether so badly established as all that. Here, at least, those perceptible relations commence in the number of the system of organs, and in their mutual connections, but there is still a greater distance from,—I do not say an identity,—but, even an appearance of a progressive process.

The head of fishes, and still better, their cranium, is divided into a number of bones, very nearly resembling that which is observed in birds and saurian reptiles, or in the lizard tribes. Now, since it happens that there is also some resemblance, though much less complete between these bones and those of the fœtus in the mammalia, and again, as the circulation of reptiles bears some relation to that of the fœtus in the mammalia, the oviparous classes, but especially the reptiles, are regarded as mammalia, arrested in the first stage of their development. And then the comparison is pushed on to the fishes, whose respiration and circulation, so far as the vessels are concerned, are very nearly the same as in the tadpoles of frogs, and other batrachian reptiles, and therefore it is concluded, that they represent the tadpoles, and that consequently they are—in some way or another, fœtuses of the second degree, the fœtuses of the fetus! But when these relations, in the number of bones, would be as complete as they are few, when we cease to remember, that precisely the reptiles most approximated to the fishes, the frog, and salamander, in all their states, have considerably fewer bones in the cranium and the face, than fishes, and even than the mammalia; this method of reasoning would not be less vicious, inasmuch as it would only take into consideration, as we have just stated, merely one or two points, and it either puts all the rest aside, or bringing them into the system by means of hypotheses, which are utterly repugnant to common sense. Let us, however, admit that the entire apparatuses are completely inverted, that the bones belonging to one organ are inserted between those of another, that the bones which, in one class, are situated at each other's sides, ascend upon each other in the succeeding class; that a combination, which had been diminishing and approaching a more simple condition, like that of the small tympanal bones, suddenly resumes the number of its components, and also an enormous size, in order to carry on a function altogether of a different nature, that of protecting the branchiæ; now, even when we have succeeded in obtaining all these concessions, what is it that we have gained? for, if an examination be made, it will be found still that the number of pieces sought for, are not forthcoming; that these pieces are not in connection in the place where they ought to be; in a word, that there is nothing what-

ever in these pretended analogies which can be at all relied on, as results of so very painful an investigation.

Let us imagine the case of a spinous apophysis, which is detached from a vertebra, and that half of it is lifted above the other; let us concede even that, under such circumstances, nature forms a different model of the pieces, and makes this articulation so complicated as that it has been called an annular joint,—shall we then have procured for this the interspinous of a fish and a ray of a dorsal fin articulated with it? By no means, because the interspinous itself is a compound of three pieces, and the ray, though it were ever so simple and sharp, is divided, still, in a vertical direction, into two equal portions. What will the consequence then be, supposing we speak of a soft ray, divided, also, into a great number of branches, and into hundreds of small articulations? So far as regards the six distinct muscles for each ray, the evidence of their having no analogues is such, that no one could venture to assign them to it, and the same result would follow, although some may say so, if a trial were undertaken for comparing the muscles of the operculum with the muscles of the small bones of the ear.

There is no question whatever as to the fact of the apparatus which supports the branchiæ having some relation, however remote it may be, with that which supports the branchial tufts of the tadpoles, or those of the sirenas and proteus. But this is a demonstration that no analogues for the larynx and branchiæ can exist in these animals simultaneously with their branchial apparatus; and can any one point out the slightest grounds for comparing the muscles of this apparatus in the two classes?

Had nature expressly provided muscles for the reptiles, and others or the fishes, why did she not make bones for each?

Some again affect to have found in the opercular pieces of the gills of fishes, actually the bones of the ear in the mammalia; but not in the shape of rudiments surely, for they are, on the other hand, enormously developed. How, then, are we to reconcile this notion with the fact that those of the reptiles which seem most to come near the class of fishes, which in their first age are nearly true fishes; that these, I repeat, meaning the salamanders, and even the frogs, should be precisely the vertebrated animals in which the bones of the ear are brought down to the very weakest and the most rudimentary condition?

The conclusion, therefore, to which we must come at last is this, that if there be any resemblances between the organs of fishes and those of the other classes, it is only because there is a corresponding resemblance in their mutual functions. We are satisfied, then, that if we can consider that these animals are mollusca raised to the rank of nobles, as it were, or mollusca promoted one degree, or if they are the fœtuses of reptiles, reptiles in the first stage of development, it can only be in an abstract and metaphysical sense that we understand the proposition, and that even then we are bound to require that this abstract expression should afford just ideas of their organization. Let us, then, conclude, above all things, that they are neither links of this imaginary chain of successive forms, no one of which could have been the germ of the others, since no one could have existed in an isolated

condition, nor lengths of this other chain, just as fanciful, of simultaneous and slightly varied forms; these chains have no existence whatever, save only in the imagination of some naturalists, much greater poets than observers, but that they belong to this real chain of co-existing beings, which are indispensable to one another and to the whole, and which, by their reciprocal influence, sustain the order and harmony of the universe; a chain, of which no link could have existed without all the others, and the foldings of which, being incessantly brought near each other or separated, comprehend the whole globe in its windings.

Methodical distribution of Fishes into natural Families and higher Divisions.

It will be obvious from all that precedes, that the distinctions between the external and internal peculiar organs which characterize fishes, are not less numerous than they are striking. There are, indeed, few classes of animals in which it is more easy to detect the genera and natural families, and from them to arrange the species. Under the slightest examination each is in a condition to exhibit the relations which place it amongst the herrings for example, or the anchovies, the megalopes, the elopes or chirocentres; or to the eels, the murena, symbranchiæ, or the cecilia. Nor are we less struck with the affinity of the countless tribes of the cyprins, the silures, salmons, perches, and those which resemble them. But to arrange these genera and families in an orderly manner, it is essential that we should fix on a small number of important characters, from which some great divisions would result, and these, without any interruption of natural relations, to be sufficiently exact so that no doubt could be allowed to exist as to the position of each fish in the classification. And this is the point to which we have not yet come in a sufficiently detailed manner.

To say the truth, the numerous peculiar characters of the chondropterygians or fishes with a true cartilaginous skeleton, or, to speak still more accurately, fishes with the granulated periosteum, were always too prominent not to have been properly estimated by every methodical mind. Every ichthyologist, therefore, has constituted these fishes into a separate order, but almost every one of them has violated the just division which they made in blending with it some fishes which had no other resemblance to them than in the softness of their skeleton.

Still these latter fishes should not be indiscriminately excluded with the crowd: there are some, such as lophius, and the lump-fish, which, with this softness, almost differ in nothing from the ordinary fishes, and cannot be separated from them; but there are, also, others with peculiar characters in their integuments, teeth, and especially in the disposition of their skeleton and head. The tetrodons, diodons, coffres, and even the balistes, are of this number. The syngnathes have also in their branchiæ distinctive characters of very great importance. The remarkable external aspect of these genera has required very much the attention of naturalists in separating them from others; but no great success has been attained in the fixing of their characters.

Artedi, for example, not only united them to the lophius and the lump-fish in the order of branchiostegal fishes, but he established the whole

of this order on a false hypothesis, namely, that these fishes had no rays to their branchial membrane*: whilst every single one was really furnished with them; and Artedi himself even actually described them in the lump-fish†.

Linnaeus, after having placed the chondropterygians in the reptiles, in his tenth edition, to which, by a combination, also without any foundation, he joined lophius; and, after having placed with the branchiostegal fishes of Artedi, the mormyri and syngnathes, and given them all the character of deficiency, not merely of rays in the gills, but also of opercula, which, so far at least as many are concerned, is at variance with the slightest observation, he united, in his twelfth edition, the chondropterygians and the branchiostegal fishes in a single order of reptiles (amphibia nantes) on a character still more strongly opposed to nature, as they possessed, at the same time, gills and lungs.

Gmelin restored the two orders of Artedi, still attributing to the branchiostegals the absence of the rays. Gouan characterizes them solely by incomplete branchiæ; an expression very vague and exceedingly debateable in almost all genera. Pennant unites them to the chondropterygians by the name of cartilaginous, a denomination adopted by Lacepede, and of which we have already seen the impropriety. In fact, it is not admissible, in either a positive or negative sense. Nobody can say, with any justice, that the skeleton of balistes is cartilaginous; and, in the number of fishes which Pennant and his followers allow amongst the osseous fishes, there are some which, as leptocephalus, have scarcely the appearance of a skeleton.

I felt it necessary to occupy myself in the first place with separating from these fishes, which are in some respect anomalous, those which are so remote from the type of ordinary fishes as deserve to be so removed, and then to find out their exact characters so as to clearly explain them in words.

This examination satisfied me that it was wrong to separate from the whole mass of ordinary fishes, the lophius, lump-fishes, centurus, mormyn†, and macrorhynchi, which differed in no essential point from ordinary fishes; but I have found that the syngnathes, whose form and economy are so singular, can be distinguished by their branchiæ in the shape of tufts concealed beneath an operculum, which allows for the exit of the water only, by a small opening in the nucha, and that the diodons, tetrodons, coffres, and balistes, independently of the incompleteness of their skeleton, and the singularity of their form, have the jaws, and in general, the whole skeleton of the head, a little different from the common fishes; that their upper jaw and their palatine bones are articulated to each other, and with the vomer by immoveable sutures, which leave them full freedom to open or close the mouth,

* It is thus, at least, that the definition given of it is explained,—Gen. pisc. titul. vers.: branchiis osseis, ossibus destitutis, et p. 85, branchiostegi in branchiis nulla ossicula gerunt.

† Gen. pisc. p. 62, membrana branchiostega ossicula sex gracilia continet.

‡ The macrohynsus of Lacepede or the silvery sygnathe of Bonneterre, is nothing more than a lepidopus imperfectly described by Osbeck.

and it is to this circumstance, in all probability, that we must refer, also, the slight motion that is left to their branchial apparatus by the skin that narrowly covers it, and which has been the impediment that prevented many naturalists from seeing it, as it was furnished with opercula and rays, as all other fishes.

But these families, once separated, nine-tenths of the fishes remain, amongst which the leading distinction that offers itself in fishes with soft fins, or whose rays are branched and articulated, and fishes with spinous fins, a portion of the rays of which are pointed small bones, without branches or articulations, or, as Artedi called them, the branches of malacopterygians and acanthopterygian fishes. Unfortunately this division is still very general, and to make any application of it we are forced to abstract the first rays of the dorsal, or of the pectorals in certain cyprins and silures, in which those rays present strong and solid spines. It is true that these spines are formed of two kinds by the agglutination of a multitude of small articulations, of which the vestiges may be detected in them.

There are still some exceptions in respect of certain fishes of the family of lobrus, and for others of that of the blennies, the spines of which are so small or so weak, or so few, that they do not seem to have any; but, with the exception of those little irregularities, were this division to be brought out not very far, at least it would not separate any fishes which nature had brought together.

But, as much cannot be said of the distinctions sought to be established by naturalists on other principles, nor of the subdivisions which they, who have adopted the great division according to the spines, have endeavoured to introduce into the two branches.

Thus, the general form of the body and the absence of ventrals used by Ray, before the character deduced from the spines obliged him to place together the eel, and lote, and goby, the syngnathes, sword fish, and mow fish.

Linnaeus was the first, in his tenth edition, to neglect the distinction which was established by the spines. He thought of dividing the ordinary fishes into apodes, jugular, thoracic and abdominal, according as they want the ventrals, or that there are attached before the pectoral fins or under them, or more backwards, he saw himself obliged to approach the sword fish, the trichiures, and the eel, and gynnotus, placing the cods between the vives and blennies, the pleurowcles between zeus and the chætodons, and the teuthis or amphi-canthes between the silurus and lori caria.

Gouan, in combining these two methods, and dividing each into the branches of Artedi, according to the four orders of Linnaeus, avoided some approximations that would have been very unnatural, and yet he placed the sword fish and the trichumes very far from the scombres: he committed positive errors, also, in making the donzelle and silurus, acanthopterygians and stromateus a malacopterygian.

M. de Lacepede resumes the characters of Pennant, and divides the fishes into the osseous and the cartilaginous; each of these classes he subdivides without respect to the fins, and with regard to the absence or presence, either of the operculum or of the branchistegal

membrane, or of both ; in fine, the last subdivisions are taken from the relative position of the ventral or pectoral fins ; a very regular distribution, and which gives thirty-two orders conceived *à priori*, but of which fifteen have not been filled up on account of not having found in nature fishes which would be related to it, and of which several would appear to have been added from error, which has caused it to be believed that the operculum or the membrane was wanted to fishes which really possessed them, such as the mormyri, the murenas, and the symbranches.

This method, beside the misplacement of the lophius and the lump-fishes, and the continual mixture of the malacopterygians with the acanthopterygians, which had already been the case in that of Linnæus, would have the disadvantage of placing the murena and synbranchia, at a great distance from the eels, which resemble them so much ; if in relation to this particularity of its distribution, it was not founded, as we have just said, on characters of which have no real existence. Nevertheless, M. Dumeril has preserved these orders in his method, which is in reality that of M. de Lacepede, subdivided after the form of the bodies and other details, in order to bring them as near as it was possible to the natural families ; but the interposition of the characters taken from the ventral fins prevent us from arriving at this conclusion.

We see, also, the lophius with the balistes and the chimera, the cod with vives and the star-gazers. Another family unites the cecilias, monopteris, and the ophisures, which are eels ; the notoportes, which are herrings ; the trichiures, which resemble the scombres, &c.

The same causes have led M. M. Risso and Rafinesque to similar results in the combinations which they have endeavoured to make of the methods of Pennant and de Lacepede, either between them, or with the natural families.

The plates which we have given in the history of Ichthyology, may be consulted for their distribution.

I cannot see that the attempts of this kind that have been recently made in Germany, have been more fortunate. Thus, M. Goldfuss, by making no other changes in the division of Linnæus, than uniting the jugulars with the thoracics, and the branchiosteges with the chondropterygians, has deprived himself of all means of classing these families in the order of their affinities. The cyclopteres and the lophii can never be put, as he places them, between the lampreys and the sharks ; nor can the trichiure be reasonably placed, as he had it, with the eels, and very far from the lepidopus, which it resembles almost in every respect ; the gnathobolus, which is a herring, can never remain with the stromateus, which is almost a chetodon.

The author himself was obliged to depart from his rule with regard to the sword-fish, which he leaves near the scombres, amongst the subbracchians, although assuredly it is an apode.

M. Oken found it more easy to arrange his families, he gave to his grand orders his fish fishes, his reptile fishes, his bird fishes, and mammal fishes ; only characters almost indeterminate, and nevertheless, from having made use of the position of the ventrals in his

subdivisions, we see him placing the herrings between the mullets and the amphacanthes (buro), the cods near the gasterestes, the sword-fish near the genus anarrhicus, and leaving the rhinchobdelles and the hog mares, in the same family with the eels.

It was only after nearly forty years of study on fishes, not from authors, but on the fishes themselves, on their skeletons, on their viscera, after having dissected several hundred species, that I became convinced of the necessity of never mixing any acanthopterygians with fishes of other families; that I learned that the acanthopterygians, which form three-fourths of all the known fishes, are also the type with which nature has taken most pains, and which it has maintained in the greatest resemblance with itself, through all the variations of detail which it has caused it to undergo.

All the other characters would only be made use of as inferior to this one, and could not be allowed to supersede it; but the extreme constancy of the general, and the predominating influence of the regulating character, has rendered it very difficult to give to fishes, in which it exists, precise and sensible applications of subordinate characters: thus, the different families of the acanthopterygians pass so insensibly into each other, that we cannot determine where one begins or another ends.

The family of pearches, for instance, which is essentially distinguished by its palatine teeth from that of the sciences, comprises a considerable group, perfectly natural in all other respects, one part of which possesses those teeth, whilst another is deprived of them.

The same thing occurs in the family otherwise well characterized, of the cuirass-jawed: the greatest part of these genera is allied to the pearches; the other to the sciænas as far as regards the palatine teeth.

There are some passages which are sensible from a part of the genera of the family of the sciences, to those of the chetodons, by the scales which cover, more or less, their vertical fins; and notwithstanding we are on the other hand obliged to bring together the family of the spares of several genera of sciænes, which have no trace of those same scales.

Transitions no less marked, unite certain genera of spares, such as the picarels and the gerres, with other genera, such as the equalus, which cannot be widely separated from the zeus, which, in their turn, lead to the family of the scombres, and this last passes by shades so fine to those fishes in form of ribbands, called tænoïdes, that it is almost impossible to say where the limit should be placed to separate them from each other.

It is therefore the duty of naturalists desirous of making known beings according to their true relations, to acknowledge that the acanthopterygian fishes, which form the old genera of pearches, the cepola, down to and comprising the sciænas, sparus, chetodons, zeus, and scombres, and other fishes in the form of ribbands, and which form, notwithstanding the innumerable quantity of their species, compose but one natural family, in which we can distinguish shades, perceive commencements of groups, and

slight separations, but where it is impossible to trace circumscriptions perfectly defined, and which did not enter at any point into each other.

But this is not exactly the case with the lophii, the batrachus, the gobies, the blennies, and especially the labrus; their characters are sufficiently precise, and though partly anatomical, can be easily assigned and appreciated. The small opening of the branchiæ in the first of these groups; its pectoral fins, the base of which is prolonged in the form of an arm; the pectorals alike joined to the ventrals and to three rays of the second; the flexible rays of the back of the third and fourth; the fleshy lips of the fifth; the total absence of cæcal appendices, in almost all those genera, separate them from the other acanthopterygians; and this last character will bring them near even the silures and cyprins, the families of which begin the order of the malacopterygians, which, on their part, as we have already observed, resemble the acanthopterygians in the spinous form of some of their rays.

The families of the malacopterygians present more differences, and traits more easy to be recognised; there are many of them as natural as they fixed in their limits, so strongly does each, in clearly separating from the other, preserve internally a great resemblance of details. This fixity is so remarkable, that most of the natural families which we shall establish in this part of the class, have been already observed by Artedi, and presented under the name of genera. His silures, cyprins, salmons, eels, and pikes may remain together; there is even no inconvenience from distributing them according to the presence and position of the ventrals; for this character, though slight, does not vary in any of them: I have merely remarked, that it impossible to retain the distinction of jugulars, thoracics, and abdominals, in the terms in which it is established by Linnæus*. It indeed matters little, whether the ventral presents itself a little before or behind the pectoral, or exactly under it; but the important circumstance, and one which depends upon the very structure of the fish, is to know if the pelvis is attached to the bones of the shoulder, or if it be but merely suspended in the flesh of the belly. I have, therefore, devised the word subbrachian, to designate fishes of the first category, whatever be the point at which their ventrals appear, which merely depends on the greater or lesser length of the bones of the pelvis; and I have left the name of abdominals to those of the second. The apodes are naturally the malacopterygians without ventrals.

We shall, therefore, commence the history of fishes with the acanthopterygians, which, in reality, constitute almost but one immense family. After these, we shall place the different families of malacopterygians in the order in which they seem to us to come nearest to to the acanthopterygians; but I do not wish to have it supposed that they draw nigh them, only on one line, and in only one series.

If the abdominal malacopterygians may be thus ranked, and even

* Those who have united the thoracics and jugulars, have only done so from my Animal Kingdom.

commencing by those which have some spinous rays, neither the apodes nor subbrachians, can be classed in their suite.

The cods, for instance, come as near as any abdominal to certain acanthopterygians, and there would be no reason for placing them after the abdominals, if it were to mark their rank in nature. If we speak of them only in their suite, it is because the facts exposed in a book can only find a place after each other.

The same observation will apply to other fishes; to those whose superior jaw is fixed; to those whose branchiæ are in tufts; and particularly to the grand and important family of the chondropterygians, by which we shall finish the history.

It is in the last, particularly, that the vanity of those systems is conspicuous, which tend to class beings on a single line. Many of these genera, the rays and sharks for instance, are raised far above the common of fishes, both by the complication of some of their organs of sense, as by that of their organs of generation, which, in some of their parts, are more developed even than they are in birds; and other genera, at which we arrive, by evident transitions, the lampreys, and the ammocetes, on the other hand, are so simplified, that some anatomists have felt authorised to regard them as the passage from fishes to articulated worms; but certainly, the ammocetes, at least, have no skeleton, and that all their muscular apparatus has only tendinous or membranous supports.

Let it not therefore be imagined, if we put a genus or a family before another, that we consider them exactly as more perfect or superior to that other in the system of beings. He, alone, could entertain such a pretension, who was pursuing the chimerical project of classing beings on a single line, and such a project we have long since renounced. The more we advanced in the study of nature, the more we were convinced that this idea was one of the most erroneous that ever had obtained in natural history, the more we discovered the necessity of studying each being, each group of beings in itself, and in the part which it plays by its properties and organization, not to make abstraction of any of its relations, or any of the links which connect it either to its neighbouring beings, or those which are far removed from it.

Once placed in this point of view, the difficulties vanish, every thing arranges itself spontaneously for the naturalist. Our systematic methods, only taken in the nearest points of relation; they will only place one being between two others, and they are incessantly at fault; the true method sees each creature in the midst of all others; it shows all the irradiations by which it is connected more or less closely in this immense net-work, which constitutes organized nature; and it is this method alone that gives us those lofty and true ideas worthy at once of nature and of God; but ten and twenty would often be insufficient to express these innumerable relations.

We warn our reader, therefore, once for all, that it is in our descriptions themselves that he must look for the idea he should form of the degrees of organization, and by no means in the place which we shall have to assign to species; and, nevertheless, we are far from thinking that relations do not exist; that no classification is

possible; and that unions and definitions of species may not be formed.

Buffon was perfectly correct, when he stated that absolute characters, and well-defined separations between genus do not always exist; that there is no means without constraint of alienating them into our methodical tables; but this great man went too far, when he rejected all resemblances, and refused all co-ordination of organization deduced from such resemblances.

These resemblances are so striking, and our mind is so strongly biassed by them, that even the people have, at all times, had their genera as well as the naturalists.

We shall, therefore, bring together what nature has stamped with resemblances, without forcing into our groups the beings which nature has not placed amongst them; not scrupling, after demonstrating, for instance, all the species which may be classed under one well-defined genus, all the genera of which it is possible to compose a well circumscribed family, to leave out one or more isolated species, one or more genera, which are not naturally connected with the others; preferring to acknowledge frankly these sorts of irregularities, if they can be so called, to leading into error, by leaving those anomalous species and genera in series, the characters of which would not embrace them.

Our list of fishes, formed on those principles, may be distributed into families nearly in the manner shown in the following table. Not being able to assign to each family an univocal and exclusive character, we confine ourselves for the present to indicating them by names derived from the genus the most known in each, that which may be regarded as the type, and from which it is most easy to form an idea of it.

At the head of each family will be found a more extensive enumeration of the characters and combinations according to which we subdivide it, and which lead us to the different genera composing it.

FISHES.

OSSEOUS.

With branchiæ in the form of combs or laminae,

WITH THE UPPER JAW FREE.

ACANTHOPTERYGIANS.

Perches,
Polynemes,
Mullets,
Mailed cheeks,
Sciænoids,
Sparoids,
Chetodons,
Scomberoids,
Sur Mullets,
Labyrinth Gilled,
Lophioides,
Gobioides,
Labroides.

MALACOPTERYGIANS.

ABDOMINAL.

Cyprinoides,
Siluroides,
Salmonides,
Clupeoides,
Lucioides.

SUBBRACHIANS.

Gadoides,
Pleuronectes,
Discoboles.

APODES.

Murenoides.

With superior jaw fixed.

Sclerodermes,
Gymnodontes.

Branchiæ in the form of tufts.

Lophobranchiæ.

CHONDROPTERYGIANS, or Cartilaginous.

Stunonians,
Plagiostomes,
Cyclostomes.

APPENDIX.

ANCIENT AND MODERN AUTHORS ON ICHTHYOLOGY.

THE chapter on this subject, in Cuvier's Natural History of Fishes, forms one of the most interesting in the whole of our great Author's works, and we feel ourselves bound to present a slight sketch of his Catalogue of the men who, from the earliest times made fishes the subject of their studies. We had intended to have arranged the following list on an alphabetical plan, but as that would destroy the regular chronological order, which is one of the most useful of its characters, as we found in going through it, we are obliged to take it as we find it.

The name of Aristotle first occurs in the work ; and the wonderful sagacity displayed by that man was never before put forth in such an elaborate manner as it is by Cuvier. The reader, however, is only acquainted by this work with what Aristotle did in the anatomy of fishes, so that we feel it necessary, in order to do the *Stagyrite* justice, to supply some notion of what he did in the other classes of Animated Nature. The whole of the scientific circles of Europe have been put into the utmost astonishment by the recent proof of the fact, that the descriptions of the Animal Kingdom now given by Cuvier, after the most laborious investigation of animals that was ever made by any one man, are actually *identical with the descriptions of Aristotle*, as we read them now in his works. We, in common with the public, have been favoured by Professor Kidd, of the University of Oxford, with a most exact translation of Aristotle's descriptions, and we shall give some specimens of the two authors upon the grand subjects of the Animal Kingdom, written at an interval which embraces *Two thousand two hundred and eighteen years !*

We beg to premise, that the translations from the Greek of Aristotle as well as of Cuvier, are the execution of that able naturalist. It may also be proper to state, that what is given from Aristotle on the subject of Fishes, was not translated by Dr. Kidd ; it was done by ourselves.

The article, then, which is given on Aristotle, is the longest of any, but it is by far the most useful. Cuvier only considers him as an Ichthyologist ; but we have ventured to extend the account of his labours.

We commence, then, with the list as given by Cuvier, and the only addition made by us is in the account of Aristotle.

ARISTOTLE.—The history of Aristotle is generally pretty well known ; we shall therefore only here recall the principal events of it.

He was born at Stagira, in Macedonia, 384 years before Christ; his father, whose name was Nicomachus, was physician to Amyntas, father to Philip, and belonged to a branch of the Asclepiades. He at first studied medicine under his father. At the age of eighteen, being left an orphan, he went to Athens, where he subsisted by the sale of drugs, which obtained for him in that city the name of *pharmacopolist*. He attended the lectures of Plato, and he himself opened a school some time before the death of his master. Philip appointed him in 356 before Christ, to be the preceptor of his son Alexander; and war being declared between Philip and Athens, in 346, A. C. he quitted that city, and took refuge at the court of Hermias, prince of Atarna, in Mycium. This prince having been betrayed and murdered by the Persians, Aristotle married his sister. Alexander was confided to his care at the age of thirteen, in 345, A. C. It is thought that he followed his pupil in his expedition as far as Egypt. In 331, A. C. he returned to Athens, and re-opened his school in Lycia. After the death of Alexander, which took place in 324, A. C., the demagogues, seconded by the sophists and platonics, accused him of impiety; and, to spare the Athenians a second attack against philosophy, he retired with his disciples into Eubœa, where he died in 322, A. C., aged sixty-three.

Here Cuvier makes a quotation from Aristotle on the fishes, which he (Cuvier) considers to be a perfect master-piece. We shall translate it, merely informing the reader that he is reading only a description of what Cuvier found in several places in Aristotle's works.

The neck is wanted; their tail is continued with the body, except in the rays, where it is long and thin: they have neither hands, feet, scrotum, virile member, nor mammilla (female breast); they ought to be distinguished from marine animals, which produce little ones alive, such as the Dolphin, whose sucking breasts are concealed near the sinuses of the vulva.

The special character of true fishes consists in their gills and fins: the majority of them have four fins; but those of an elongated form, as the eels, have only two. Some, as the murena, are entirely without them. The rays swim with the whole of their body enlarged. The gills are sometimes furnished with an operculum, sometimes they are without it; and this is the case in cartilaginous fishes: in some they are simple, in others double. It is remarkable that the sword-fish has eight gills on each side; each of these gills is divided into two combs. No fish has either hair or feathers; the greater part are covered with scales, some with a rough or smooth skin. Their tongue is hard, frequently armed with teeth; sometimes so adherent, that they appear to be mantled, and this is on account of their being obliged to swallow rapidly; it is for the same reason that their teeth are generally crooked.

Their eyes want eyelids. We cannot see either their ears or nostrils, for what is in the place of the nostrils is only a blind cavity. They have nevertheless the faculty of taste, smell, and hearing; as the author proves from numerous experiments. All of them have blood: all the scaly ones have eggs; but the cartilaginous, if we except the lophius, bring forth living spawn. They have all a heart, a liver, and a gall bladder; and in this respect he enters into very particular and true details upon the biliary vesicles of some fishes, amongst which is the amnia; but he is mistaken in refusing kidneys and a bladder to fishes.

Their intestines vary very much; there are some, such as the mullets, which have a fleshy gizzard like birds; others have scarcely any apparent stomach. Blind appendices adhere near to their stomach, they are very numerous in some, but much less so in others. There are even some which are entirely without them, as in the greater part of the cartilaginous fishes.

Along the spine are two organs which supply the place of testicles, of which the excretory canals terminate at the anus, and which become very large during the time of spawn.

Their scales remain as long as their lives. Being without lungs they have no voice, properly speaking, and nevertheless there are several (which he names) which make sounds and a kind of croaking. They are subject to sleep the same as other animals. In greater part of the species, the females are larger than the males. In the rays and the squalus, the male is distinguished by appendices on each side of the anus.

Not only had Aristotle made numerous observations, from which he deduced such exact rules; but he has also represented by plates these different conformations.

As to the species, Aristotle knew and named one hundred and seventeen, and he enters upon their manner of living, their journies, their friendships and hatreds, the stratagems they employ, their amours, the time of spawn, of their laying and fecundity, the manner of catching them, and the time when their flesh is best.

Cuvier observes that nothing at all is done in modern times to compare with this, and it is evident, that to have collected such an enormous mass as he did, of the most curious facts that are upon record.

There is another remarkable fact which is connected with our time, and happens to be one of the profoundest interest, namely, that he (Aristotle) implicitly believed in the truth of spontaneous generation. We can only say that this is a doctrine which has been treated with contempt for the last two thousand years, and yet the belief of it seems now to be very nearly justified by the extensive labours of European naturalists.

We now proceed to give the passages contributed by Professor Dr. Kidd.

GENERAL PHYSIOLOGY.

Aristotle.

In some animals there is a mutual resemblance in all their parts; as the eye of any one man resembles the eye of every other man: and it is the same with respect to the constituent parts of the horse, or of any other animals which are said to be of the same species: for in individuals of the same species each part resembles its correspondent part as much as the whole resembles the whole.

All animals have certain common organs, by means of which they lay hold of, and into others of which they convey, their food. The organ by which they lay hold of their food is called the mouth; that, into which they convey it, is the stomach: but the other parts are called by various names. The form and relative proportions, structure, and position of these parts, are the same in the same species, but vary in different species of animals.

Cuvier, tom. I.

Every organized body has its peculiar form; not only generally and exteriorly, but even in the detail of the structure of each of its parts; and all the individuals which agree in the detail of their structure are of the same species.

The leading character of animals is derived from the existence of a reservoir for their food, that is, an intestinal canal, the organization of which varies according to circumstances.

Aristotle.

In addition to the mouth and stomach, most animals have other common parts by which they exclude the refuse of their food: but in some animals these parts are wanting.

There are fibres of a peculiar kind in the blood; by the removal of which, that fluid is prevented from coagulating: but if they are not removed, it does coagulate. And through defect of these fibres the blood of the deer and of some other animals does not coagulate*.

The particular senses are five in number, sight, hearing, smell, taste, and touch. Of these the sense of touch is alone common to all animals; and is so generally diffused over the whole body, that it is not said to reside in any specific part. All animals do not possess all the senses; some possess only a part of them. But no animal is without the fifth sense, that of touch.

All animals which draw in and breathe out the air have lungs. Those animals which employ water, analogously to air, in respiration, have gills.

Animals in general appear to have a certain degree of intellectual power, and some are capable of instruction. Some animals are cautious; some are cunning. Man alone is capable of meditation and reflection. Many animals possess memory: no animal but man is capable of recollection.

In the greater number of animals there are traces of the moral affections of man; for some are mild, and some are fierce. And the same thing may be very readily discerned in children, for in them we may perceive the germs of their future habits; and indeed the dispositions

Cuvier, tom. I.

The lowest animals have no other outlet for the refuse of their food, than that by which they admit the food itself.

The blood contains a principle called *fibrine*; which, within a short time after the blood has been withdrawn from the body, manifests itself in the form of membranes or filaments.

The most general external sense is that of touch; its seat is the surface of the whole body. Many animals are without the sense of hearing, and of smell, and of sight. Some have none of the senses except that of touch, which is never wanting.

When the element subservient to the process of respiration is the air, the organ of respiration is the lungs: when water, the gills.

Even the most perfect animals are infinitely inferior to man in the intellectual faculties; although it is certain that their intelligence performs similar operations to those of the human mind: and they are capable of instruction. Man has the faculty of associating his general ideas with particular images of a more or less arbitrary character, but easily imprinted in his memory, which serve to recall to him the general ideas which they represent.

Animals are susceptible of emulation, and jealousy, &c. In short, we may observe in the higher animals a certain degree of the reasoning faculty, which appears nearly the same with that of infants before they have acquired the power of speech.

* It is deserving of notice, that the animals whose blood is said not to coagulate, are such as are usually killed in hunting; and it is understood by physiologists in general, that excessive exercise and violent mental emotions, both which occur in hunted animals, prevent the blood from coagulating.

Aristotle.

of human beings at that early period of life do not differ from those of the inferior animals.

As man possesses contrivance, and wisdom, and comprehension; so some animals possess a certain natural power, which, though not the same as, in some respects resembles, those faculties.

All animals which have red blood, have a spine or backbone: but the other parts of the bony system are wanting in some species, and present in others. The spine is the base or origin of the bony system: it is composed of vertebræ, which are all perforated; and extends from the head to the hips: and the cranium is a continuation of its upper or anterior extremity.

Red-blooded animals when in their perfect state have either no extremities, or they have one or two pair. Those animals which have more than two pair are not red-blooded.

In some animals the corresponding limbs are different in form, but analogous in use. Thus the anterior extremities of birds are neither hands nor feet, but wings. Fish have no limbs, but appendages, called fins, commonly four in number, sometimes two.

The red-blooded animals are man, viviparous and oviparous quadrupeds, birds, fish, cetaceous animals, and snakes, &c.

Animals of the largest size are found among those which are red-blooded. All animals which have colourless blood are smaller in size than those which have red blood; with the exception of a few marine animals, as some of the sepia.

All red-blooded animals have the five senses.

Cuvier, tom. I.

In a great number of animals there exists a faculty, different from intelligence, which is called *instinct*.

The first general division of animals includes all those which have a spine or backbone consisting of separate portions called vertebræ. The animals of this division are called *vertebrated*. They have all of them red blood: their body is composed of a head, trunk, and members: the spine, which is composed of vertebræ, having each an annular perforation, and moveable on each other, commences at its upper or anterior extremity from the head; the lower or posterior extremity usually terminating in a tail.

Their extremities never exceed two pair in number: sometimes one pair is wanting, sometimes both.

The form of the extremities varies according to the uses to which they are to be applied; the anterior extremities being hands, or feet, or wings, or fins; the posterior, feet or fins.

The division of vertebrated animals includes man, the mammalia consisting of viviparous quadrupeds and the cetacea, birds, reptiles of all kinds, many of which, though oviparous, are quadrupeds, and fish.

Vertebrated animals, all of which have red blood, attain to a much larger size than those whose blood is colourless.

Vertebrated animals have always two eyes, two ears, two nostrils, the integuments of the tongue and those of the whole body.

MAMMALIA.

Aristotle.

No animal which is not viviparous has breasts; and even of viviparous animals those only have them which produce their young alive at once, without the intervention of an egg.

The milk is not, as the blood is, a fluid which animals possess from their birth, but a subsequent secretion; and is contained in the breasts. And all those animals have breasts which are essentially or directly viviparous; as man, and such quadrupeds as are covered with hair; and also cetaceous animals, as the dolphin, the seal, and the whale.

Cuvier, tom. I.

The animals of the class *mammalia* are essentially viviparous; inasmuch as a direct communication is established between the embryo and the parent immediately after conception.

The new born offspring is nourished for a time by milk, which is a special and temporary secretion from the mammae; organs, so exclusively peculiar to this class, as to have determined the distinctive appellation *mammalia*. This class includes all the common viviparous quadrupeds; together with the seal, and the dolphin, and other cetacea.

MAN.

All animals which have limbs resembling those of man, have their legs, and thighs and hips, sparingly covered with flesh; whereas in man these parts are more fleshy than any other.

Of all animals man has, in proportion to his size, the largest brain; and the smallest interval between his eyes; and the most delicate sense of touch and of taste.

No animal but man has its breasts in the front of the chest; the elephant, like the human female, has two breasts, but they are placed on the side.

No animal but man has the faculty of articulate speech; which consists of vowels pronounced by means of the larynx, and of consonants formed by the tongue and lips: the dolphin, therefore, which has a voice in consequence of its possessing lungs, and a larynx, cannot articulate, because its tongue is not readily moveable, and it has no lips.

The muscles which extend the foot and thigh of man are more powerful than those of any other animal: and hence the calf of the leg is particularly prominent. The part called the pelvis, situate between the hips, is altogether proportionally larger in man than in any other animal.

No quadruped has so large a brain as man. His eyes are placed as to be necessarily directed only forwards. In the delicacy of the sense of taste and touch man excels all other animals.

The female breasts are placed in front of the chest.

He possesses an advantage peculiar to himself in the organs of voice; for he alone is capable of uttering articulate sounds; a power which apparently depends on the form of his mouth, and the great flexibility of his lips.

APES, &c.

The feet of apes are peculiar, and resemble large hands, the toes being like fingers, and the under surface of the hind-foot like the palm of the

The hind feet of the quadrumana (to which *order* apes belong) have a thumb capable of being opposed to the other toes, which are as

Aristotle.

hand, but terminating in a badly shaped heel. Hence they often use their feet as hands. Their arms resemble those of man, as also their hands, and fingers, and nails; and they bend their extremities in the same direction as man does*. The upper part of their body being larger than the lower part, as is the case with decided quadrupeds; and their feet partaking of the character of hands; their pelvis moreover being small; they are from these joint causes incapable of continuing long in an erect position.

Like man they have two mammæ on the chest; and their internal anatomy resembles the human.

Some of the apes (pithekoi) resemble man in many points, as to their face: for they have nostrils and ears; and both their front and back teeth not much unlike those of man.

Cuvier, tom. I.

long and as flexible as the fingers; whence they are capable of climbing well; but they do not easily walk, or support themselves in an erect position, because their pelvis is narrow, and the plane of the under surface of their feet is not horizontal.

In the character of their intestines, in the direction of their eyes, and in the position of their breasts, they resemble man; and the structure of their fore-arms and hands enables them to imitate us in many of their gestures and actions.

The higher species of apes have flat nails; and teeth very much resembling the human both in number and arrangement, and also in form; and they have no tail.

THE HEDGEHOG AND PORCUPINE.

Porcupines and land-echini, or hedgehogs, are covered with spines, which are properly to be considered in these animals as a kind of rigid and indurated hair; for these spines do not serve the purposes of feet, as they do in sea-echini.

Hedgehogs have their bodies covered with quills instead of hair; and so have porcupines.

THE MOLE.

All viviparous animals have eyes, except the mole; and even this animal, although it has neither the faculty of sight, nor eyes readily visible, cannot be said to be altogether without eyes; for if its skin be taken off, you may distinguish not only the natural situation of the eyes, but that black central part of the eye itself in which the pupil is contained; as if these organs had been imperfectly developed, and the skin had grown over them. If the skin, which is thick, be stripped off

The eye of the mole is so small, and so concealed by the skin, that for a long time this animal was supposed to be without eyes. The blind rat-mole has no visible trace of external eyes; but in taking off the skin, a very small black point is observable, which appears to have the organization of an eye, without the possibility of being employed as such, because the skin passes over it not only in an entire state, but as thick and as closely covered with hair as in any other part of the

* The same is true of quadrupeds in general: in most of which, however, Aristotle mistook the joint at the heel and wrist, for that of the knee and elbow.

Aristotle.

from the head, you may perceive on its inner surface, and in the usual region, distinct eyes; which, though small and shrunk, as it were, have all the essential parts of those organs, namely, a pupil placed in the centre of the black part of the eye, and that black part surrounded by the white.

Cuvier, tom. I.

face. This may probably be the animal which, according to M. Olivier, gave the idea to the ancients of describing the mole as totally blind*.

THE BEAR.

The bear is an omnivorous animal, living on various fruits, on honey, on ants, and on flesh; attacking not only the smaller animals, but even wild boars and bulls†. The feet of the bear resemble hands; and for a short time this animal can walk erect on its two hind feet.

The bear, though so powerful an animal, is not disposed to feed on flesh, unless when compelled by want of other food. Bears walk on the whole sole of the foot, and are thus enabled to raise themselves with comparative ease in an erect position on their hind feet.

THE SEAL.

The seal brings forth its young on shore, but passes most of its time in the sea, and derives its nourishment from thence. With respect to its extremities, it may be considered as an imperfect quadruped; for immediately in succession to its shoulder-blades it has feet resembling *hands*‡; and on each foot are five toes, and each toe has three joints: the hind-feet in their shape resemble the tail of a fish. All the teeth of the seal are sharp and pointed, as indicating the approximation of their nature to fish; almost all fish having teeth of that character. The seal has a cloven tongue.

The feet of the seal are so short, and so enveloped in the skin, that on land they only serve them for crawling; but, as the interstices of the toes are filled up with membrane, they act as excellent oars; and hence these animals pass the greater part of their life in the sea, only coming to land for the purpose of basking in the sun and suckling their cubs. They have five toes on each of their feet; and on the hind feet the outermost and innermost are longest, the intermediate being shortest. All their teeth have either pointed or cutting edges. Their tongue is indented at the extremity.

THE ELEPHANT.

The elephant has five toes on each foot; though the joints of these are not very distinct. It has four teeth on each side of its mouth, with which it triturates its food, and

Elephants have on each foot five toes, very well defined in the skeleton, but so imbedded in the callous skin enveloping the foot, that they can only be recognised externally

* By an examination of Aristotle's description, it is evident that the ancients knew the true state of the case, namely, that the mole has eyes.

† Its mode of engaging with the bull is thus described by Aristotle; "In engaging the bull, the bear throws itself on its back; and, while the bull is attempting to toss it, the bear takes the bull's horns between its paws, and thus overthrows its adversary.

‡ From the shortness of the arm and fore-arm in this animal, Aristotle overlooked these parts.

Aristotle.

makes it as smooth as bran: and besides these it has two very large teeth. It has a long and powerful proboscis, which it uses as a hand; for with this organ it takes up and conveys to its mouth both solid and liquid food. Its intestines have appendages, presenting the appearance of four stomachs: and it has two mammæ placed by the side of the chest, near the axillæ. The cub of the elephant sucks with its mouth, and not with its proboscis*.

Cuvier, tom. I.

by their nails, which are attached to the edge of this hoof as it were. They have two tusks, which sometimes grow to an enormous size; and either four or eight grinding teeth on each side, according to the periods of their development. The proboscis, terminating in an appendage like a finger, gives to the elephant a degree of address equal to that which the hand of the ape imparts to that animal. The elephant uses this proboscis for the purpose of conveying solid food or pumping up liquids into its mouth. The intestines of the elephant are voluminous; it has two mammæ placed under the breast, and its cub sucks with the mouth, and not with the trunk.

RUMINATING ANIMALS.

All viviparous quadrupeds which have horns are without the front teeth in the upper jaw; and some indeed which have no horns have the same defect with respect to the teeth, as the *camel*.

Of viviparous quadrupeds some are cloven-footed and have hoofs instead of claws, as the ox, sheep, goat, and deer. The same animals have four stomachs, and are said to ruminate.

With the exception of the deer, all ruminating animals have horns which are partly hollow, and partly solid; the hollow part grows out of the skin, of which it is indeed a continuation; but that part round which this hollow is fitted is solid, and grows out of the bone; as in oxen.

The horns of most animals are, in their form, simple, and are hollow, except at their extremity; the horns of the deer alone are in their form arborescent; and, in their substance, solid throughout.

With the exception of the *camel* and the musk, all the animals of this order have horns; and all are without front teeth in the upper jaw.

The feet terminate in two toes, each of which is covered with a separate hoof, and is opposed to its fellow by a flat surface; from whence they are called cloven-footed. The animals of this order are called *ruminating*; and have always four stomachs.

The structure of the horns differs in different species. In some the solid osseous part which projects from the frontal bone is covered with a hollow case, which grows over it from the skin, as in oxen, sheep, and goats.

* Camper says that in almost all points the anatomy of the elephant is correctly represented by Aristotle; the apparent inconsistencies arising from his having dissected a young elephant. Tom. 2, p. 205, &c.

Aristotle.

The deer alone, from the age of two years, sheds its horns annually; the horns of other animals are permanent, unless separated by violence. Deer at the age of one year have merely the rudiments of horns, short sprouts, as it were, covered with downy skin. At the age of two years they develop straight horns like wooden pegs; and are hence called at that period *πατταλίαι*.

At three years their horns have two branches; at four years, more; and in this way the number of branches increases till the animal is six years old; after which the number is not increased.

The horn at first grows as it were in the skin, and has a soft villous covering; and after it has attained its full growth, the animal exposes itself to the sun, in order to ripen and dry up this covering.

Cuvier, tom. I.

In the various species of deer the osseous projections are covered, during their growth, with skin resembling that of the rest of the head. This skin subsequently perishes, leaving the osseous horn uncovered; and, after a time, the horns themselves are shed; and are succeeded by others which are usually larger than the preceding; and these again are shed in their turn and replaced by others.

The figure of the horn in deer varies according to the age and species of the animal.

CETACEOUS ANIMALS.

The dolphin and whale, and other cetaceous animals, which have not gills, but a tube for conveying away the sea-water received into their mouth, are viviparous; and they respire air, for they have lungs; and hence, if caught in a net, and unable to come to the surface for the purpose of breathing, they are suffocated.

The dolphin utters a kind of murmur when it is in the air; for it has a voice, inasmuch as it has lungs, and an air-tube leading to them; but having no lips, and its tongue being not sufficiently moveable, it is unable to utter an articulate sound.

The dolphin has mammae, not placed in the anterior part of the body, but near the vent.

The mildness and docility of the dolphin are remarkable.

These fish swim in large flocks, and their swiftness is so remarkable that they have been known to spring over the masts (decks?) of ships.

Cetaceous animals remain constantly in the water; but, as they respire by means of lungs, they are obliged to come often to the surface for air. p. 272. The ordinary cetacea possess a remarkable apparatus, from which they are called *blowers*, by means of which they discharge through their nostrils a large volume of water which they take into their mouth with their food. p. 275.

They have no prominent laminae in their glottis; and hence their voice is nothing more than a simple lowing. p. 276.

Their mammae are placed near the vent. p. 276.

The general organization of the dolphin's brain shews that it possesses the docility usually attributed to it. p. 278.

The common dolphin, which is found in large flocks in every sea, and is remarkable for its swiftness of motion, so that it occasionally darts over the decks of ships, ap-

Aristotle.

The cetaceous animal called mysticetus has no teeth, but hairs instead, like hogs' bristles.

Cuvier, tom. I.

pears evidently to be the dolphin of the ancients. p. 278.

The upper jaw of the balænae is furnished with thin transverse laminae closely set, formed of a kind of fibrous horn, terminating in a bristly fringe at the border. p. 284(a).

THEOPHRASTUS was the son of a fuller, named Melancthus, and born 370 years before the Christian era; he was at first called Tyrtamus, but Aristotle gave him the surname of Theophrastus, on account of his divine eloquence. He was at first a disciple of Lencipus and of Plato. Tenderly beloved by Aristotle, he succeeded him in the chair of philosophy, in 324, and had more than a thousand disciples; he formed one of the first botanical gardens. His two principal works of natural history, are nine books of the history of plants, and six of the causes of plants, a kind of vegetable physiology; he is much better known on account of his characters, translated and so ingeniously imitated by Labruyere. It is said that he lived one hundred years, and that the people of Athens assisted in a body at his funeral.

LUCIUS APULEIUS was an inhabitant of Madaura, in Africa. He was contemporary with the Antoninus, and author of a curious romance called *the Golden Ass*. He employed twenty pages of his first apology in justifying himself for his curiosity in his researches upon fishes, and to prove that it was not for magical operations. It is evident from this discourse, that he has written much upon this class of animals, but his works on this subject are not extant.

☞ (a) We cannot omit the following observations on the above result of a most happy combination of ingenuity and sagacity, on the part of Dr. Kidd, with which he closes his account.

In comparing, then, the zoology of Aristotle with that of the moderns, it has not been my intention to prove that the classification of the one is built upon equally clear and extensive demonstrations as that of the other; but to shew, as in harmony with the general object of this treatise, that, even in the very dawn of science, there is frequently sufficient light to guide the mind to at least an approximation to the truth—to much nearer approximation, indeed, than could have been antecedently expected by those who are not accustomed to reflect philosophically on the uniformity of the laws of nature. Thus, as has been already mentioned, the advancement of science has shewn the existence of such a general coincidence and harmony of relation between the several component parts of an individual animal, that even a partial acquaintance with the details of its structure will frequently enable the inquirer to ascertain its true place in the scale of organization. And hence, although Aristotle knew nothing of the circulation of the blood, or of the general physiology of the nervous system, and even comparatively little of the osteology of animals, yet subsequent discoveries have scarcely disturbed the order of his arrangement. He placed the *whale*, for instance, in the same natural division with common quadrupeds, because he saw that like them it is viviparous, and suckles its young, and respire by lungs and not by gills; and with viviparous quadrupeds it is still classed; the circulation of its blood, as well as the arrangement of its nervous system, being essentially the same as in that class of animals. And, notwithstanding the difference of its form, its osteology, which holds an *analogy* throughout with that of quadrupeds, is the same *actually* in a part where it would be least expected; for, with the remarkable exception of the sloth, all viviparous quadrupeds have exactly seven cervical vertebræ, and so has the whale; whereas fish, to the general form of which the whale closely approximates, having no neck, have no cervical vertebræ; and the deficiency of the neck in fish was recognized by Aristotle.

MARCUS TERENCE VARRO, who was considered the most erudite of the Romans, was born 116 years before Christ, and died 28 years before that period. We only speak of him here on account of his *Treatise de rerustica*.

LUCIUS JUNIUS MODERATUS COLUMELLA, contemporary with Claudius, was born at Cadiz, and was author of twelve books : *De re rustica*.

OVID is not one of those men whose lives it is necessary to recall the history. It will suffice to note, that he was born 43 years before the coming of Christ, exiled ten years after the birth of Christ, and died seven years after. It was during the last seven years of his life that he composed his poem of the *Halicutiques*, if this work really belongs to him.

PLINY, the elder, (Caius Plinius secundus) one of the most laborious and erudite men of antiquity, was born at Verona, 23 years before the Christian era; he studied at Rome, visited the coast of Africa, served in the Roman armies of Germany, remained in Spain during the civil wars which followed the death of Nero, and died, commander of the Roman fleet, 79 years after the birth of Christ, on account of his taking too little caution in observing the great eruption of Vesuvius. His natural history, in thirty-seven volumes, dedicated to Titus, is the only work of his that remains. He passed a great portion of his life in collecting the materials with an ardour and perseverance which surpasses all imagination. It is composed of extracts from more than two thousand volumes, from authors, of whose works we do not possess more than forty volumes.

OPPIAN, of Anazarba, in Cilicia, was born towards the end of the reign of Marcus Aurelius; his father fell into disgrace with Severus, and was sent into exile. The poetry of Oppian was so much liked by Caracalla, that, it is said, he pardoned his father, and granted him a statera of gold for each verse. He died from contagion, in his native town, about his thirtieth year. The fifth book of his *Cynegetics* and all his *Ixeutics*, in which he treats on birds, are lost; but his *Habintics* are wholly preserved.

ATHENIUS, author of *Deiprosophists*, was an inhabitant of Naucrata, in Egypt. The dinner of which he gives a description, and at which he assisted, is supposed to have taken place in the house of a man (Larentius), whom Marcus Aurelius had honoured with employments of confidence; consequently he lived in the second century, and, nevertheless, he quotes Oppian, who did not write till the commencement of the third. It is true that Belin de Buller thinks that the quotation was not made by Athenius, but merely by the person to whom we owe the abridgment of the two first books of his work. In effect, we have only his two first works in the form of abridgment; the others are entire, or nearly so. There are fifteen in number.

The time of ELIAN, author of the *History of Animals*, is uncertain; nevertheless, it is generally placed in the second century, or at the commencement of the third, because he is thought to be either Claudius Elian, de Prenesta, who taught rhetoric at Rome, after the reign of Antoninus, according to Suidas, or Elian the sophist, whose life Philostratus wrote, and who some say died after Commodus, and others after Elagabalus. It is impossible that these two Elians should be the same person; but it is said that neither of them wrote upon natural history.

DECIUS MAGNUS AUSONIUS, was born at Bordeaux, and was preceptor to the Emperor Gratian, and consul in 379; he died 394. Amongst his poetry is a little poem on the Moselle, in which he describes the fishes in that river.

STRABO, the father of Geography, was born at Amasa, in Cappadocia, about fifty years before Christ, and died during the reign of Tiberius. He names several fishes of the Nile in his seventeenth book, and in other places speaks of fishing for thons and pelamydes

PAUSANIAS, author of *Travels in Greece*, flourished under Antoninus. He compared, in his *Messeniacs*, the fishes of Greece with those of Egypt.

PEDACIUS DIOSCORIDUS, of Anazarba, in Cilicia, who is thought to have lived under Nero, mentions five or six fishes in his second book on *Materia Medica*. There is also a fragment of a poem of Marcellus, contemporary of Antoninus, in which he names sixty fishes, but without any other indication.

GALEN is another of those men too well known for us to mention any thing about except a few dates. He was born at Pergama, towards the year 131; having studied at Alexandria, he went to Rome in 169, became physician to Marcus Aurelius, and after the death of that prince returned to Pergama, where he died in 200. He is the last of the ancient anatomists. It is in his treatise *De alimentorum facultate*, where he speaks of a great number of fishes relative to the qualities of their flesh.

ORIBASTES, was physician to the Emperor Julian, about the middle of the third century. In the second book of his *Collecta medicinalia*, after having copied the above mentioned chapters of Galen, he adds rather a long one taken from a Treatise of Xenocrates, upon the aliments furnished by fish, in which are several names and facts very useful.

It is not known who this Xenocrates was; some suppose him to have been, but with a very slight degree of probability, that he was academical philosopher, the second successor of Plato.

Saint AMBROSE, archbishop of Milan, was born about the year 340, and died in 397. The eleven first chapters of the fifth book of his *Hexameron*, are consecrated to the description of fishes.

EUSTATHIUS, archbishop of Antioch, one of the prelates of the council of Nice, says in his *Hexameron*, or commentary on the work of six days, but a few words on the saw-fish, the scarus, the echeneis, and the sea-fox.

MANUEL PHILE, born at Ephesus, towards the year 1275, and died in 1340, has put into verse the facts relative to the history of animals borrowed from Elian.

Saint ISIDORE, bishop of Seville, lived towards the end of the sixth century, during the reigns of the Emperor Mauricus and of King Ricardus: he composed many works on theology, history, and erudition. The twelfth book of his *Origins*, is the only one of his works interesting to the naturalist.

ALBERT, called the Great, of the family of the counts of Bollstedt, was born at Laningen, in Sonabe, in 1193. After having studied at Padua, he went to teach the philosophy of Aristotle at Paris, and there obtained a great reputation as professor. He entered, in 1221, into the order of Dominican Friars, and became Provincial in Germany, in 1254; then, master of the sacred palace at Rome; and, in 1260, Bishop of Ratisbonne: he finished by entering his monastery, where he died in 1280. His works, printed at Lyons in 1651, occupy twenty-two large volumes in folio; his sixth and fourteenth books relate to fishes.

VINCENT DE BEAUVAIS, a Dominican friar, who, it is thought, died in 1256, and whom Albert the Great survived twenty-four years, compiled a work truly prodigious, on account of the number of subjects it contains, and which may be called the encyclopedia of the middle ages. It is his *Bibliotheca mundi sive Speculum majus*, divided into four parts, of which the first, entitled *speculum naturale*, an enormous volume, in folio, embraces the entire of natural philosophy and history. It is said that the king (some say Philip Augustus, others Saint Louis) procured for him the books and copiests requisite for such an undertaking. He speaks of fishes in his seventeenth book.

PAUL GIOVIS, was born at Coma, in 1483, and died at Florence in 1552. He was rather celebrated as being one of the elegant Italian writers.

His first work, less known than his others, is a Latin treatise on fishes, *De Romanis piscibus Libellus ad Iudovicum Borbonium*.

PETER GILLES, born at Alby, in 1490, was sent by Francis I. to the Levant, but having no support, he found it necessary to enrol himself in the troops of Soliman II. He redeemed himself, and returned to Hungary and Germany, but died at Rome, in the house of Cardinal d'Armagnac, in 1555. He has left a history of fishes of Marseilles.

ED. WOTTON, an Oxford physician, author of a work entitled, *On the Differences of Animals*; but it is merely a compilation from the ancients, without containing any thing new.

The Author, after mentioning LORICERUS, whose work he disposes of with a few unfavourable expressions, adds, that the authors whose works are described after those of Aristotle and Theophrastus up to the present moment, were of very little value, and he observes that it was not until about the middle of the sixteenth century that the men sprang up who laid the foundation for modern Ichthyology.

PETER BELON, the first of the three authors alluded to, was born in 1518; and studied in Germany: after travelling in Italy and the Levant, he returned to Paris in 1550, and he obtained from Charles IX. a place in the Chateau de Madrid, at the Bois de Boulogne, near Paris, where he was assassinated in 1564. He published four works, and their particular object is to give the natural history of foreign sea fishes.

HIPPOLYTE SALVIANI, a physician, born in 1513, is author of a work with beautiful and exact plates on a large scale.

WM. ROUDELET, born at Montpellier, in 1507. He has left us wood engravings of sea fishes, much more beautiful and exact than any of his predecessors.

CONRAD GESNER, a Swiss, born in 1516; he left five large volumes on the history of animals, and of fishes especially, illustrating those of Venice, England, and Germany.

ULYSSES ANDROVANDI, a Bolognese, devoted his fortune to the illustration of natural history. He was born in 1527.

ANDREW THEVER, a Grey Friar, who flourished in 1550, wrote a celebrated book entitled *Singularities of Antarctic France*, which name he applied to Brazil.

JOHN DE LERY, a Protestant minister, a traveller to Brazil, who gives an account of its fishes in his voyage.

CHARLES DE L'ECHUSA, well known as Chiseus, born in Arras, published some plates of the Chundra, Diodons, and a few others.

JOHN DELAET, born at Antwerp, at the end of the 16th century, a splendid promoter of natural history.

JOHN EUSEBIUS NIEREMBERG, a Jesuit, born in Madrid 1590, published an account of a great number of fishes in his work, "*Foreign Natural History*."

FRANCIS HERMANDEZ, a Spanish physician to Philip II, composed a natural history of Mexico, which, however, came ultimately through other hands, and in piece-meal.

WILLIAM PISON, a physician who accompanied a Dutch expedition to Brazil in 1640. He was assisted by Margrave.

JAMES BONTIUS, a physician of Batavia in 1625, gave descriptions of the fishes of that country. This work was enlarged by Nieuhoff, a native of Bentheim, in Westphalia.

JOHN BAPTIST DURTXE, a Dominican monk, a missionary to the Antilles, described the Antilles, and particularly the fishes of the lakes, rivers, &c.

ROCHFORT, a Rotterdam Protestant minister, also gave the world a history, natural and moral, of the Antilles.

PETER ANDREW MATTIOLI, born at Senna in 1500, added several fishes to those of Gessner.

FERRANTE IMPERATO, a Neapolitan physician, added several Mediterranean fishes.

The names of the various contributors which succeed, must be now given more briefly, and we shall therefore mention the name, birth, or period when the author flourished.

	Birth-place.	Year of Birth, or in which he flourished.
FABIUS COLUMNA.....	Naples	1567
CASPAR SCHWENKFELD	Silesia	1603
ETIENNE DE SCHOMELDE	Hamburgh.....	1624
ROBERT SIBBALD.....	Edinburgh.....	1684
JEROME FABRICIUS	Aqua	
HARVEY MASTER	Pendente	1565
JULIUS CASSERIUS	Padua	1606
M. AURELIUS SEVERINUS	Tarissa	1610
JOHN ALPBOURNS BORELLI.....	Pisa	1608
MARCEL MALPIGHI	Bologna.....	1628
NICOLAS STENON.....	Copenhagen	1638
WILLIAM HARVEY	Folkstone, Kent	1577
VOLCHER COITER	Nuremberg	1534
CASPAR BARTHOLIN.....	Schonen	1585
GERARD BLASIUS.....	Bruges	1682
JOHN SWAMMERDAM.....	Amsterdam	1637
J. G. DUVERNEY.....	Tours.....	1648
PAUL S. BOCCONE	Palermo.....	1663
ANTONIO VALISNIERI	Modena.....	1700
GAUTHIER NEEDHAM	London	1660
G. C. SCHELHAMMER	Jena	1649
OLAUS BORICHUS.....	Denmark	1627
OLIGER JACOBUS	Do.....	1650
M. B. VALETHUS.....	Giessers.....	1657
S. COLLINS	England.....	1685
JOHN JOHNSON.....	Scotland.....	1603
JOHN RAY	England.....	1628
FR. WILLOUGHBY.....	Do.....	1672
HANS SLOANE	Ireland	1660
MARCO CATESBY	London	1680
GRIFFITH HUGHES	England	1750
GEORGE EDWARDS	Do.....	1743
C. G. ZORGRADER	Holland.....	1720
HANS EDGE.....	Norway.....	1721
NIC. HORREBON	Denmark	1752
ERIC PONTOPPODAN.....	Norway	1750
L. F. COUNT DE MARSIGLI.....	Italy	1682
WILLILM POSMAN.....	Holland	1705
FRANCIS LEGUAT.....	France	1638
J. B. LABAT.....	Paris	1663

	Birth-place.	Year of Birth, or in which he flourished.
CORN. LEBRUN	Holland	1714
PAUL LUCAS	France	1666
PETER KOLBE	Germany	1712
CORN. DE VLAMING	Holland	1715
LOUIS RENARD	Do.	1720
F. VALENTYN	Do.	1706
ENGELBERT KÖMPFER	Westphalia	1688
P. F. X. DE CHASLEVOIX	France	1689
CHARLES PLUMIER	Do.	1646
LOUIS FEUILLEE	Do.	1660
J. G. DAGOTY	Do.	1752
PETER ARTEDI	Sweden	1724
LINNÆUS	Do. b. 24 May, 1707, d. 1778.	
GRONOVIVS, AND HIS FAMILY	Hamburg	1740
M. BRISSON	France	1723
P. BROWN	England	1756
F. HASSELQUIST	Sweden	1757
PETER OSBECK	Germany	1757
ALBAR SABA	Holland	1700
A. RUSSEL	Scotland	1756
J. T. KØLRUTER	Germany	1763
HANS STRØM	Norway	1766
ADAM OLEARIUS	Germany	1620
JAMES PETIVER	London	1716
A. GARDEN	Scotland	1730
J. D. MEYER	Germany	1748
J. HILL	London	1750
G. W. KNORR	Germany	1767
A. DE NOBLEVILLE AND SALERNE ..	France	1756
W. H. KRAMER	Germany	1756
J. T. KLEIN	Do.	1685
H. L. DUHAMEL		
DU MONCEAU	France	1740
T. PENNANT	England	1798
A. GOUAN	France	1770
P. S. PALLAS	Germany	1741
P. COMMERTON	France	1727
L. A. DE BOUGAINVILLE	Do.	1729
P. SONNERAT	Do.	1776
J. BANKS	England	1770
D. SOLANDER	Sweden	1760
JAMES COOK (the celebrated Cap- tain Cook)	England	1773
S. PARKINSON	Do.	1773
J. R. FORSTER	Polish Prussia	1729
G. G. A. FORSTER	Germany	1760
BOWDICH, Mrs. (now Mrs. Lee, an English lady, still living).		

Birth-place.
Year of Birth, or
in which he flourished.

P. FORSKALL	Sweden	1760
C. NIEBURGH	Germany	1760
D. T. MESSERSCHMIDT	Do.	1685
J. G. GMELIN	Do.	1750
G. W. STELLER	Russia	1734
J. P. FALK	Sweden	1730
S. T. GMELIN	Germany	1770
J. A. GULDENSTEDT	Russia	1760
J. T. GEORGI	Pomerania	1760
J. LEPKCHIN	Russia	1790
N. RYLSCHKOU	Do.	1774
J. C. FABRICIUS	Duchy of Slesvic	1779
O. FABRICIUS	Do.	1780
E. OLFASSEN	Iceland	1740
P. ASCANIUS	Norway	1767
O. F. MULLER	Denmark	1770
C. P. THUNBERG	Sweden	1759
M. HOUTTUYN	Holland	1761
J. BROUSSONET	France	1786
M. T. BRUNNICH	Sweden	1768
T. CELTI	Italy	1774
J. CORMDE	Spain	1788
J. C. WULFF	Germany	1765
J. B. FISCHER	Do.	1778
J. C. BIRKHOLZ	Do.	1770
N. G. LESKE	Do.	1774
BARON DE MEIDENGER	Do.	1794
F. SCHRANK	Do.	1786
W. MARSDEN	England	1788
J. MOLINA	Italy	1789
J. R. FORSTER	England	1771
J. HERMANN	Germany	1760
J. A. SCOPOLI	Italy	1725
M. E. BLOCH	Germany	1723
R. H. HAUY	France	1812
N. BONATERRE	Do.	1800
J. J. WALBAUM	Germany	1780
J. F. GMELIN	Do.	1760
F. P. DUPETET	France	1664
WM. CHESELDEN	England	1688
A. HALLER	Germany	1736
PETER CAMPER	Do.	1722
F. VICQ-D'AZYR	Valonia	1748
A. MUNRO	London	1697
F. D. HERISSANT	France	1724
G. HEWSON	England	1774
R. A. FERCHAND DE REAUMUR	France	1683
J. N. J. ALLEMAND	Germany	1713
COUNT DE LACEPEDE	France	1756

	Birth-place.	Year of Birth, or in which he flourished.
G. SHAW	England	1751
F. CUPANI	Italy	1657
D. VIVIANI	Genoa	living
A. SPINOLA	Do.	do.
M. GIORNA	Turin	do.
M. BONNELLI	Do.	do.
M. OTTO	Breslau	do.
M. RAMZANI	Bologna	do.
F. L. NACCERI	Italy	do.
D. NORDO	Do.	do.
CAPTAIN KRUSENSTERN	Cronstadt	do.
CAPTAIN BAUDIN	France	do.
CAPTAIN FREYCINET	Do.	do.
CAPTAIN DUPERREY	Do.	do.
M. RAFINESQUE	Italy	do.
M. DE BLAINVILLE	France	do.
M. GOLDFUSS	Do.	do.
M. RISSO	Italy	do.
M. O'KEN	Germany	do.
J. H. F. AUTENRIETH	Do.	do.
G. ST. HILAIRE	France	do.
C. G. CARUS	Germany	do.
L. H. BOJANUS	Polish Russia	do.
G. BAKKER	Germany	do.
VAN DER HOEVEN	Do.	do.
J. F. MECKEL	Do.	recently deceased
M. DUMERIL	France	living
SIR E. HOME	England	lately dead
M. M. TIEDMANN, AND DÖLLINGER	Germany	living
M. FOHMANN	Do.	do.
M. RUDOLPHI	Do.	lately dead

The more recent labours of naturalists are next noticed by Cuvier, and the following are the names of men who have recently performed voyages, or have in some other way devoted their time to the illustration of the natural history of Fishes.

M. M. Peron and Lesueur.

The late M. Delalande.

M. Augustus St. Hilaire.

Prince Maximilian of Neuwied.

M. M. Richard and Leblond.

M. Pointeau, Leschenault, and Ad. Doumère.

M. Pley, a victim to his love of nature in South America.

M. Lefort, physician, and M. Achard, apothecary, colonial residents; as also M. Ricord, M. Poey, M. Bosc, M. M. Milbert; Dr. Mitchell of New York; M. Lesueur, M. Dekay, M. Richardson, M. Roger, M. Marceschaux, Sonnerat, Leschenault, M. Mathieu, M. Diard, and Duvaucel, M. M. Kuhl, and Van Hesselt, M. Reinward,

M. Alfred Duvaucel, M. Dussumier, M. Ehrenberg, M. Tilesius, M. M. Langsdorf, Temminck, Risso, Bonnelle, Savigny, Biberon, Leach, De Rigny, Baille, Polydore Roux, D'Orbigny, Garnot, Bailon; and several other gentlemen are mentioned, who assisted in procuring the author many specimens (*a*).

☞ (*a*) As a great many new principles have been disclosed by comparative anatomy, which apply to the illustration of the anatomy of man, we feel it to be only our duty to give the latest of the very curious and important facts, ascertained respecting the relations of the peculiar structure of fishes, to that of man. The following statement is taken from the work of a Berlin medical gentleman, only recently published in that city; and it is upon the subject of the branchial openings of the human foetus, as a cause of malformation.

On the Branchial or Gill-like Openings in the Neck of the Human Fœtus, as a cause of certain Malformations.—M. Ascherson, the author of this memoir, lately published in Latin at Berlin, has called the attention of his medical brethren to a curious congenital anomaly, or “vitium formationis,” which he has observed in several persons. The number of cases altogether amounts to eleven; and most of them occurred in female children, of a scrofulous, or at least of a lymphatic constitution. The authenticity of most is guaranteed by the testimony of that able physiologist Rudolphi. The following may be given as a brief description of the disease:—On the anterior and lateral part of the neck there is observed a fistulous opening, which is situated generally in that triangular hollow between the clavicle and the two points of insertion of the sternomastoideus; but sometimes it is at the inner edge of this muscle. It is much more frequently found on the right than on the left side; and if there should happen to be one on either side, that on the right is always larger and placed somewhat higher up than the other one. The aperture is invariably very narrow; occasionally scarcely visible, but at other times it is surrounded with a red circle, or it may project like a papilla. It generally follows the movements of the pharynx in deglutition, and when this is the case, we observe a transverse furrow, at the bottom of which is situated the fistulous opening. If a probe be introduced, it may perhaps be pushed forwards a little way, but in most of the cases it is stopped very soon, in consequence of the sinuosity of the canal. In one case, fluid, injected at the outer opening, passed into the pharynx, and the patient was sensible of its taste; and in another, the attempts made to cure the fistula in this way were followed by disagreeable consequences, such as swelling of the neck, smarting pain, and the sensation as if a foreign body was sticking in the pharynx. On no occasion was any air ever observed to escape from the opening, even when the effort of respiration was strong, while the mouth and nostrils were kept closed. The discharge from the fistula was sometimes viscid and clear, and at other times, more of a purulent appearance; and it was remarked that in the latter case, the quantity of the discharge was always more profuse. Although this disease be congenital, it may increase after birth beyond its original extent. Eight of the cases seen by Dr. Ascherson, occurred in females, and three in males. These fistulæ now described have some analogy with the tracheal fistulæ recently discovered and explained by M. Dzondi; but the origin and the anatomical characters of the two are very different. In order that we may compare them, we have extracted the following remarks from Dzondi's narrative:

“At the anterior part of the neck, about the middle of the concave edge of the thyroid cartilage, there is found a small round opening, of about a line in diameter; its edges are neither red, tumefied, nor surrounded with any fleshy rim. It is not painful on being touched; and when firmly compressed, several drops of a puriform fluid may be made to flow out. A probe cannot be pushed very deep, in consequence of the winding track of the fistula, and on no occasion can it be introduced into the trachea, although a few bubbles of air almost always escape upon any forcible srepitation.”

These tracheal fistulæ may be associated, or occur in connexion with other congenital anomalies or irregularities of formation; especially with those which are denominated “monstrosities from asymphysis,” that is, from an incomplete junction of the two lateral halves of the body. We cannot, however, take the same view of those

described by M. Ascherson, because they are not situated in the median line of the body; and as they have no communication with the air-passages, we must necessarily infer that their origin is not similar. He is of opinion that they should be regarded as proceeding from some anomaly or aberration of the *nisus formativus*, congenial with those which cause an arrest of the development of the *fœtus*, during one of those phases which it successively passes through, before it reaches its perfect state. To one of these transition forms belong the branchial fistulæ discovered by Rathke, first in the young of the pig, horse, hen, water-snake, (*coluber natrix*) and lizard, and afterwards in a human embryo, about seven or eight weeks old. These fistulæ or tubes consist in from six to eight apertures, arranged symmetrically on either side of the neck, opening into the pharynx, covered externally with a sort of operculum, and exhibiting on their inner surface several arched lamellæ. Rathke compares these apertures with the branchial apertures of the shark; and a beautiful confirmation of this opinion may be derived from the identity which exists in the vascular arrangements of fishes and of the early chick, as clearly made out and described by M. Huschke of Dresden. This anatomist publicly demonstrated that the aorta of the young chick gives off six branches, which pass on to the inner surface of the branchial arches, (or those lamellæ which are considered as rudimentary branchiæ), and which afterwards communicate with, and terminate in, the descending aorta. Bäär has verified the existence of these branchial apertures in the *fœtal* dog and rabbit; and his observations have been confirmed by Burbach, Muller, Allan, Thompson, and Becker. M. Rudolphi mentions having seen at Stralsund, an infant in whom the closing up of a fistula of this sort, brought on aphonia, epileptic convulsions, and other alarming symptoms, which gave way only when the ulcer was re-established, and the discharge permitted to flow. In one of the cases related by Dzondi, the healing of the fistulous opening was followed by a train of evils which finally proved fatal.

END OF VOL.II.

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